March 2011

The Story of Armor featuring the Power to Pierce Armor

Fernando J. Martell
Worcester Polytechnic Institute

Jacquelin Amber Blair
Worcester Polytechnic Institute

Nicholas G. Roumas
Worcester Polytechnic Institute

The Progression of Arms and Armor from Ancient Greece to the European Renaissance across Eurasia and Africa

Featuring: *The Power to Pierce Armor*

An Interactive Qualifying Proposal

Submitted to the Faculty of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for graduation

By

Jacquelin A. Blair

Fernando Martell

Nicholas Roumas

March 4, 2011

Professor Jeffrey L. Forgeng, Major Advisor

ABSTRACT

Gunpowder revolutionized not only the medieval battlefield, but the face of Western society, dethroning the knight from his battlefield dominance and helping to usher in modern governmental forms. This project for the Higgins Armory Museum documented the social history of the museum's arms collection, synthesizing the research into a 15-minute video documentary on the rise of firearms and the decline of armor, c. 1300-1800. The documentary features animations and reenacted footage specifically created for the production.

Table of Contents

Introduction

The invention of firearms and gunpowder was a turning point a history, where not only military tactics and strategy were reformed but the very essence of society was changed from chivalrous knights to mercenaries armed with firearms. The Knight, a fierce and chivalrous warrior, a position of power and prestige but only if you came from a family that could afford to send you to a lord that had a higher position in society. Anyone had the ability to have a firearm and use it and the Knights were no longer needed. With the loss of the knights came the increase of power for the Monarchs over the Church, who thrived on the loyalty of these warriors who would fight for them in the name of God. Mercenaries became the tool used most often as they were cheaper than training and arming a knight, most often their ranks consisted of those from the lower class.

Very few people know that firearms were the reason behind the decline and extinction of Knights and Medieval armor as it seems to many that there is a jump in history from the time of the very recognizable Knight to today's version of firearms. The majority of the project focused on creating a video that focused on the story that directly followed Chivalry and ignited a series of events that would change society at its roots using various artifacts at the Higgins Armory Museum, historical paintings, footage of modern re-enactors, interviews with historians of the museum and narration by Anika Blodgett/Holly Fletcher.

Prior to choosing to tell the story of firearms, this WPI IQP group has researched the arms and armor following the progression from Ancient Greece to the decline of armor in the European Renaissance. While following this vein in history, the group also compared European designs to the designs of Asian and African armor at the larger points in history. Each section focused specifically on the historical, military, social and technological aspects of the age and used the artifacts owned by Higgins Armory Museum to demonstrate and guide the direction of these four research topics.

Topic one focused on the Ancient world beginning with Ancient Greece and their use of bronze and wood in their armor and more specifically the Corinthian helmets displayed in Higgins Armory. The story continued into the end of the Roman Republic and beginning of the Roman Empire and their ability to use and adapt both Greek and Celtic armor centered on the Montefortino Helmet and Gladiator Helmet.

Topic two carried the story into the European Middle Ages where tournament and more decorative armors were used. Knightly weapons research took up much of the Middle Ages segment and gave way to the European Renaissance where Pikes, Rapiers, Short Swords, ¾ Cuirassier armor and finally firearms were discussed.

The previous two topics focused solely on Europe but they were not the only ones affected by the use and decline of armor and various arms. Topic three focused on the Ottoman Turkish Panoply and the Sudanic Panoply from Turkey and Africa, respectively demonstrating the differences in the use of leather and cloths along with chain mail armor against that of the iron and steel armor of the Knight. The final topic displayed

the armor and tradition of Eastern Asia in Japanese Armor and weapons as well as those from Mughul India.

Knowing many different stories across Europe, Africa and Asia led this group to the decision of choosing a topic for the video documentary – firearms. Previous groups have effectively covered the Medieval Knight and its importance and society, as well as pointing out that firearms were the knight's downfall but no one has gone farther until now. Modern day military men do make use of new armor, beginning with the design the helmet used in World War I with the help of John Woodman Higgins (founder of Higgins Armory Museum) but the impact of firearms has been quite explosive.

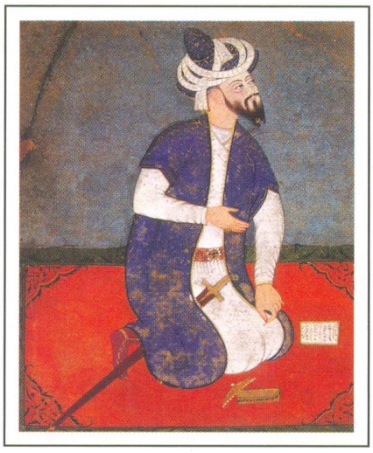
Historians believe that gunpowder made its way to Europe from China around the time of the Mongol conquests during the 1200s. By the late 1300s, gunpowder weapons had become a standard feature of European armies. The first combat-effective handgun came into being in the late 1400s. Known as the arquebus or "hooked gun," this weapon had a sturdy wooden stock that allowed it to be aimed more precisely and helped to control the recoil when fired. Another improvement in the arquebus was the ignition system, called the matchlock.

The greatest danger to the arquebusier was the cavalryman. The arquebus was still fairly weak against armor: an armored knight was safe only 50 yards away from a line of arquebusiers.

Since the knight could cover this distance in under 10 seconds, the arquebusier could only get one shot off before the cavalry came crashing in on him. To fix the problem, armies protected their arquebusiers with large numbers of armored pikemen.

Firearms became even more effective in the late 1500s with the introduction of the musket, a more powerful and accurate version of the arquebus that could pierce plate armor at even greater distances. The power and accuracy of this musket required a longer and thicker barrel, making the weapon so heavy that the musketeer needed a forked rest to support it. The increasing power of firearms forced cavalry to adapt their armor, giving up protection on the arms and legs in favor of heavier protection on the head and chest.

By the late 1500s, craftsmen were producing a new ignition system known as the wheel-lock. Instead of a burning matchcord, the wheel-lock used a spring-loaded wheel scraping against pyrite to generate sparks, in a mechanism comparable to a modern lighter. Cavalry were issued short wheel-lock firearms like this carbine and this pair of pistols from the Higgins collection The wheel-lock was safer than the matchlock and also allowed the weapon to be fired in wet weather, but it was expensive and easy to break.



At the same time, gunpowder's shockwaves were spreading to other parts of the world. The Emperor Babur founded the Mughul dynasty in India during early 1500s thanks to his skill

in exploiting the new technology. His Central Asian cavalry were used to shooting bows on horseback, and they had little trouble adapting to firearms; the staple of the Mughal army was to also use armored war elephants to carry cannons or people on their backs.

But the most dramatic impact of firearms was in Japan. Arquebuses were introduced by European traders in the 1540s, and the Japanese quickly began manufacturing their own improved versions. It was the great warlord Tokugawa Ieyasu, the unifier of Japan, who first realized the potential of the new weapon. In 1575, Tokugawa used his guns decisively at the battle of Nagashino. The opposing warlord, Takeda Katsuyori, was laying siege to Nagashino Castle when Tokugawa approached with an army that included over a thousand arquebusiers.

After Tokugawa became Shogun of Japan in 1603, he and his successors banned firearms except in a few licensed arsenals. The Tokugawa shoguns feared that gunpowder weapons were a threat to traditional samurai society and might be used to start a rebellion. Firearms would not become a significant part of Japanese armies again until the late 1800s when Japan re-opened contact with the outside world.

Tokugawa's suspicions about firearms were borne out by events back in Europe. In the late 1600s, European armies replaced pikes with bayonets, a short blade that attached to the end of the musket. Now every musketeer could serve as his own pikeman, and the modern infantryman came into being.

At about the same time, the older matchlock ignition was replaced with the flintlock, which created sparks with a sharpened flint striking against a steel surface. Before firing the wielder would cock the hammer containing the flint. When the trigger was pulled the flint would strike a metal piece to expose the pan and creating sparks that ignited the powder.

This made the musket far more reliable, while improving metal technology allowed the weapon to become lighter, no longer requiring a rest. By 1700, armor had given up the arms race: armor that could stop a bullet was too heavy to wear in battle, so soldiers gave it up entirely except for a few specialized and ceremonial uses.

The changing military technology brought social revolution in its wake. The power of the old feudal aristocracy was based on the power of the knight, trained since childhood in the arts of hand-to-hand combat, and using an expensive horse and armor that only a nobleman could afford. Now an ordinary farmer or laborer could be trained for battle in a matter of weeks, armed with a cheap, quantity-produced firearm. It became increasingly difficult for the rulers of Europe to impose their will on the people who made up the backbone of their armies.

Figures

Ancient Greece

Higgins Armory Museum – The Corinthian Helmet

One of the earliest civilizations, Ancient Greece, set the foundations of many subjects studied today, including literature in the form of the *Iliad*, mathematics, philosophy, and much more. Going through history, it can also be seen that their military tactics, arms and armor were the basis for many advances in later civilizations.

Figure 1. Corinthian Helmet. HAM # 2037

The pieces at Higgins Armory that represent the rich history of Ancient Greece are a series of Corinthian Helmets. These headpieces date from the Archaic Period to the Classical Period in Greece, which includes the fall of the Mycenaean civilization, the formation of *poleis*, the Persian Wars, and the rise of Alexander's Macedonian Empire.

Mycenaean Civilization

The Mycenaean civilization was established around 1650 B.C. and fell c. 1200 – 1000 B.C. The early history of this civilization was noted for its peoples' penchant for all things Minoan. Through the observation of Mycenaean artwork, it is thought that the southern part of Greece had been a Cretan colony. The Minoan civilization of Crete can be traced back to 3000 B.C. and was the strongest power in the Aegean, where much of warfare, early weapons, and armor types originated. The most important invention was the chariot, though it seems that the Mycenaean people had introduced it to their Minoan neighbors. ("*Mycenaean c.1650 – 1100 B.C."* p4).

There were small clay tablets found on Crete that described everyday political decisions and military information, from which it was determined that the earlier Minoan culture was not where the Greeks had originated and that the Mycenaean language was actually an early form of Greek. Much of what was discovered to have come from this civilization was compared to the stories that were uncovered, the most prominent being Homer's *Iliad*. Around 1400 B.C. the

center of Minoan power on Crete, Knossos, was destroyed—probably by an earthquake. The Mycenaeans took advantage of their weakness, rebuilt Knossos as a Mycenaean power, and took over Crete. In doing so, they made themselves the strongest power in the Aegean. ("*Mycenaean c.1650 – 1100 B.C.*" p5).

After the Mycenaean civilization was destroyed a little after 1200 B.C., the savage northern tribes came down from the mountains of the northwestern region and settled in southern Greece. The original people of Greece fled to the west coast of Asia Minor (today's Turkey) and named the new territory Ionia. (*Greece and Rome at War*. p2). Around 1000 B.C., they broke into small cities, using the mountains to divide their territories. Each of the small cities that centered around a *polis*, or natural citadel, where they paid homage to their patron god or goddess and generally had walls surrounding the city for protection. (*With Arrow, Sword and Spear*).

Ancient Greece: Archaic Period: Hoplite Phalanx Formation

In the seventh century, King Pheidon of Argos invented the hoplite phalanx, a new style of fighting that quickly became popular. *Hopla* referred to all of the equipment that a warrior had to carry, which consisted of a helmet, breastplate, greaves (shin guards), a spear and a shield. Generally the shield was referred to as the *hoplon*, and was circular, covering a warrior from chin to knee. The second half of the name, *phalanx*, refers to the formation in which the warriors would stand next to each other, shoulder to shoulder, with each man's shield covering the man to his left so there were few weak points open to attack. (*With Arrow, Sword and Spear*).

Figure 2. Spartan Hoplite

King Pheidon of Argos used the hoplites against Sparta in 668 B.C., Sparta being the greatest power in Greece since their conquest of Messenia the century before. Sparta was defeated, and they immediately began training their own hoplites with the phalanx formation. This defeat also provoked the exiled people of Messenia to lead a revolt against Sparta. For twenty years, Sparta used this new style of fighting to extinguish the rebellion. (*With Arrow, Sword and Spear*).

Sparta's goal was to defeat the Laconia, a neighboring city-state to the south, and when they succeeded, the Spartans turned much of their population into *helots*, or slaves, who were tied to Sparta and worked their farmlands. Other Laconians were given the status of subjects under Spartan rule and were allowed a measure of freedom, but needed to provide soldiers to fight alongside the Spartan army when called upon. (*Greece and Rome at War*. p2).

By the end of the 600s B.C. Sparta had conquered Messenia to the west and controlled the entire Peloponnesus. Within one hundred years, they managed to unite the Peloponnesian states that, in ancient times, were called the Lacedaemonians. (*Greece and Rome at War*. p2).

When Sparta had finally defeated the Messenian people, they were further exiled from their original lands and a new class of people was formed. The hoplites in Sparta were permanent warriors who were always ready at a moment's notice to fight for their king. Each hoplite was awarded land for his support and lived communally in a military camp. The hoplites followed the laws of their king and a council of twenty-eight aristocrats who were above the age of sixty years. They were uniquely able to hold councils and vote on issues that pertained to them and their style of life. (*With Arrow, Sword and Spear*).

The Spartans were descended from the Dorians, who were the fiercest of the tribes to come down from the mountains when Mycenae fell. (*Greece and Rome at War*. p2). Spartan life was intense and lived by the idea that even their women were necessary in their military support. "As the duty of the men was to fight and, if necessary, die in battle, so the duty of women was to produce sons to fight in battle. As the noblest sacrifice of the man was death in battle, so the noblest sacrifice of the woman was death in childbirth." (*With Arrow, Sword and Spear.* Pg. 67)

The hoplites began their training early, starting at age six. They learned to write, play music, and read, and underwent physical training until they were about ten years old. For the next few years, the boys would compete in music, dancing, and athletics, and at the age of thirteen they were put into more intensive training. At this time they were given one garment to last them until they turned eighteen and shaved their heads. The boys often trained and played naked. When a boy reached manhood, at the age of eighteen, he either supervised younger boys in their training or joined the secret police of Sparta (*krypteia*) that held the law against the Messenian helots. When a young man reached the age of twenty-one, he lived in the barracks

and was ready to fight at a moment's notice until he was thirty years of age. After his time in support of the force, he was expected to maintain a household, and when he reached sixty years of age, he was released from military service. (*With Arrow, Sword and Spear*).

Every polis reformed its own military forces in accordance with the phalanx formation after they saw the success that Argos had defeating Sparta. Hoplites were often very important to the aristocrats in war, but aristocrats tried to ignore them during times of peace. The hoplites held enough power that they were able to hold council and use their political power to ensure that their leaders did not ignore them. Not all poleis were able to compromise, and hoplites would choose a champion warrior and force them into tyranny. This lead to most of the poleis becoming hoplite democracies, leading a reformation of Greek social and political life. (*With Arrow, Sword and Spear*).

Ancient Greece: Archaic Period: Sparta Rises In Power and the Challenge of Persia

By the middle of the sixth century, Sparta was the leading military power with the largest and best army in Greece. They led Messenia and Laconia and attempted to conquer all of the Peloponnesus, but failed. When they were unable to do so, they took up a policy against tyranny, supported the development of hoplite democracies, and sought to dominate the Peloponnesus through their allies. They were challenged by the Argives in 546 B.C. for leadership of the Peloponnesus, but won. At the same time, one of the Spartan allies, Lydia, was defeated by Cyrus of Persia. Sparta sent an envoy to Persia saying that they would not tolerate Persian presence in Ionia. (*With Arrow, Sword and Spear*).

Figure 3. Map of Ancient Greece

The Persian ruler, the Great King Darius, led his massive armies to build up his empire. By the end of the 600s B.C. Babylon fell, the Lydian Empire fell soon after, and in 500 B.C. the Greeks in Asia Minor were threatened. They turned to their fellow Greek states across the sea

and help was given by Athens and Eretria. They sent expeditionary forces to Ionia, which resulted in the sacking and burning of the capital of the Persian province, Sardis. Persia responded and put down the revolt and sold the population into slavery by 494 B.C. Darius then turned his attention to the rest of Greece. (*Greece and Rome at War*. p12).

An emissary was sent to each Greek city state requesting earth and water, which was the traditional symbol of submission. Of all the city states, only Aegina submitted to Persian rule. This city state was key because it lied in the Saronic Gulf, only ten kilometers off the Attic coast, and controlled access to Athens' harbors. Athens appealed to Sparta, since Aegina was a part of the Lacedaemonian alliance, and they forced Aegina to revert to their former loyalties. (*Greece and Rome at War*. p12).

In 490 B.C. Persia overthrew Eretria and moved down the bay of Marathon to attack Athens. An Athenian runner made his way to Sparta to request their aid, but the Spartan army was held up by a festival. It was traditional not to go to war during religious festivals. By the time the Spartans had made their way to Marathon, Athens had already defeated Persia and driven them out of Attica. (*Greece and Rome at War*. p12).

During the next ten years, Athens built up its navy and many city states began building up their armies until Persia made their second attempt to invade. A congress was assembled at the Isthmus of Corinth, which connected the Peloponnesus with the rest of the Greek peninsula, to attempt to settle the differences between various Greek city states. In 480 B.C. the Persian army marched through Macedonia and Thrace with various men from all around the known world making up the combatants. They had composed their troops from all of their subject nations, most of whom were only good for light skirmishes, including archers from central Asia and javelineers from the Eastern Mediterranean. The Persians and Medes formed the central part of the army. (*Greece and Rome at War*. p12).

Figure 4. Persian Soldier

The Persians and Medes did not wear armor, but instead wore loose caps, mail shirts under multicolored tunics, and breeches. Their shields were wicker and may have been covered

in hide; they were similar in appearance to Boeotian shields. Their weapons consisted of a 2-meter short spear, a long composite bow with bronze tipped arrows and a dagger that hung at their right side. A group that was singled out was the king's personal bodyguard of 10,000 "Immortals." Their name derived from the fact that the guard was kept at 10,000 soldiers and thus never seemed to die to Persian enemies. Their status could also be seen in the richness of their clothes and equipment. (*Greece and Rome at War*. p12 - 13).

Ancient Greece: Classical Period: Battle of Thermopylae: Greece vs. Persia

The current king of Sparta, Leonidas, upon hearing about the Persian army making their way to Greece under Darius's successor, Xerxes, took his bodyguard of 300 Spartan soldiers, 2,800 other Peloponnesian soldiers and 4,000 helots made their way to the pass at Thermopylae. Along the way, they were joined by 700 Thespians, 400 Thebans, 1,000 Phocians, and the entire Locrian army. Upon their arrival they set about fixing the wall that had been previously erected by the Phocians to keep out Persian invaders. (*Greece and Rome at War*. p14).

Xerxes and his army marched through Thessaly as its people had moved farther south in order to stay out of reach of the Persians. They arrived at Lamia and waited for the fleet that was supposed to meet them, but after four days of waiting Xerxes ordered his Medean and Cissian subjects to request submission of the Greeks. When this failed, he sent forth the Immortals, but they were at a disadvantage, since their massive numbers made no difference in the narrow passage in which the Greeks fought. Their spears were also shorter than the Greeks' and required the wielder to get much closer to his enemy, placing himself in a perilous position. Thusfar, most of the fighting occurred from the Spartan bodyguards and their hoplites, so when on the following day Xerxes delivered the order for the entire army to attack, the entire Greek force fought as well. (*Greece and Rome at War*. p17 – 18).

During the battles that raged between the Greeks and the Persians, Leonidas had been sending runners requesting reinforcements, but it quickly became clear that none were coming. The Spartans lived by a code of honor that forbade them from ever deserting their posts, and when word reached them that the Persians had a local man bringing them through the pass that led directly behind their lines, a council of all the Greek generals was held. At this meeting, most expressed their desire to retreat, and Leonidas allowed them to return home. Along with the

Spartans, only the 700 Thespians and 400 Thebans stayed behind to face the Persian forces. (*Greece and Rome at War*. p20, 23).

Once the Persians had made it through the difficult pass, they waited to attack until mid-morning and found their foe spread out in a normal phalanx formation across the widest part of the passage. The battle raged on, the Greeks realizing their deaths were at hand and fighting viciously. At the end of the battle, only the Persian army was left alive, though seriously depleted. The Persian ay advanced on defenseless Greece and burned Athens, but was forced to retreat when their navy was crushed at the Battle of Salamis, the navy being the lifeline of the Persian land forces, which were far too numerous to sustain themselves without a naval supply line. The following spring, Xerxes re-invaded, but the more heavily armored Greek soldiers once again prevailed at the battle of Plataea, bringing an end to Persian aspirations of further westward expansion. (*Greece and Rome at War*. p23).

Ancient Greece – The Corinthian Helmet

Figure 5 Corinthian Helmet. HAM # 239

During the classical period, there were several forms of Greek helmets, but they all seemed to have evolved from two main types: the Kegel and the primitive Corinthian, the latter proving the most successful and common helmet in all its variations. These helmets covered the entire head, leaving only the eyes, nose, and mouth clear, and originated in the 700s B.C. with additions made in the 600s B.C. These changes included an indentation in the bottom edge of the helmet, diving the jaw line from the neck line, and cheek guards. The cheeks were very flexible so that the helmet could be pulled down over the head and still fit the soldier's face. They were also able to lift the helmet up so the cheek guards were resting around the forehead, a manner in which they wore the helmets during moments of peace. The inner side of the helmet also held padding since the bronze was effective mainly in preventing piercing, while the padding aided in lessening the blow behind forceful hits. The only fault that these helmets had was they inhibited the soldier's ability to hear. Thus, soldiers fought until one side had clearly won. These types of helmets died out in Greece in the early 400s B.C., but continued to evolve in Italy. (*Greece and Rome at War*. p60 – 61).

Early Roman Republic

Higgins Armory Museum – The Montefortino Helmet

Figure 6. Montefortino Helmet HAM #

The piece at Higgins Armory that represents the rich history of the Early Roman Republic is the Montefortino Helmet. This style of helmet was the earliest used by the soldiers in the Republican Army from 400 B.C. to end of the 100s B.C. As can be seen in Figure 6, there were movable cheek guards to protect the sides of the face, but the back of the neck was left unguarded. The notch at the top part of the helmet was used to hold a plume, which served for decoration as well as a distinguishing mark between soldiers and officers.

After the death of Alexander the Great, the fragile Macedonian Empire slowly fell to the Romans until it was no more. The circumstances for their rise to power lie in the battle of the Allia where the Romans fought and were defeated by the Gauls in 390 B.C. The Gauls then chased them all the way to Rome and occupied the city, refusing to leave until the Romans paid them to do so. (*With Arrow, Sword and Spear*, pg. 167).

This led to the Roman people putting their trust, army, and state in the hands of Camillus for reformation. Camillus organized the Roman social classes into *centuries*, the highest class being those who owned horses, which were the most expensive property that could be owned in those times. This class, called the *equites*, had eighteen centuries. The next level down was class-one centuries, which contained eighty centuries who were able to afford a panoply. This included a helmet, shield, breastplate, greaves, sword and spear. Class-two centuries could afford all that the class-one centuries could except for the breastplate. Class-three and four centuries could only afford the shield and weapons, while class-five centuries only had slings. Below these five classes were those centuries who were armorers, trumpeters, and horn blowers, and a single century to those without property of their own. Each century was also able to have one vote on the issues. Politically, Rome had gone beyond other city states and their aristocracy recognized the people (Plebians) as having a “corporate” identity. Those with lands were able to hold office

and vote. Eventually, this allowed for a system in which there was one consul for each aristocrat (Patrician) for each pleb in office. (*With Arrow, Sword and Spear*, pg. 167).

Early Roman Republic – Roman Army Formation

The army that Camillus formed was one that would be used for decades throughout Roman history. The front lines consisted of the *hastati*, or spearmen, organized as maniples (a subdivision with 60 to 120 men) of two centuries, each with thirty men, armed with the oval shield and spear, as well as the leves, who were light-armed soldiers. Behind the *hastati* were the *principes*, strong men who were at the height of their prime in life, also organized in maniples. Following the *principes* were the *triarii*, or the older veteran soldiers who were relied on for aid and their knowledge, then the *rorarii*, who were the younger, least experienced soldiers. The final lines were the *accensi*, or those men who were considered the least dependable in battle. All Roman soldiers were armed with a helmet, a wooden shield reinforced with bronze, and eventually the pilum, or Roman throwing spear. (*With Arrow, Sword and Spear*, pg. 168).

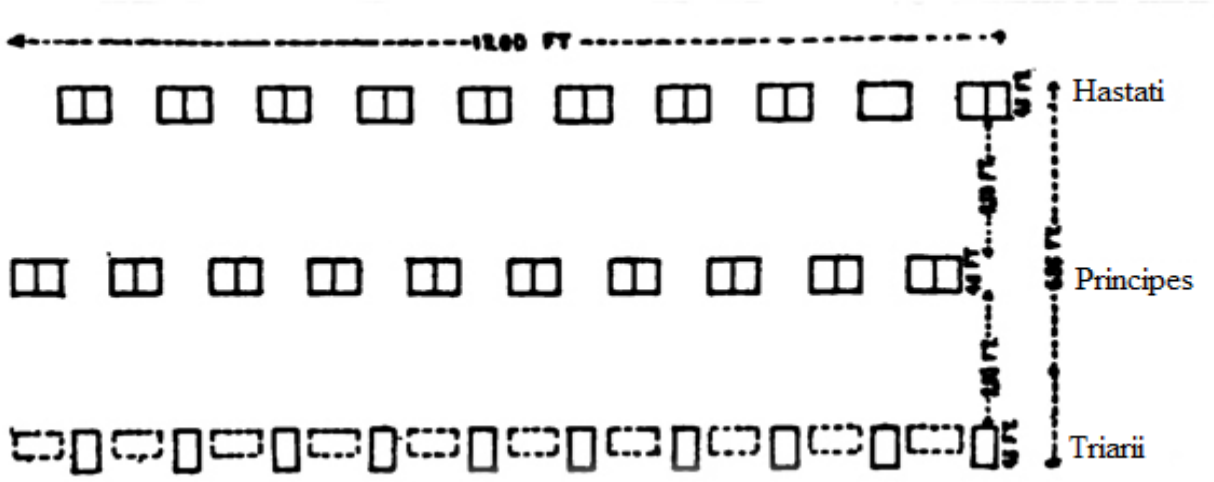


Figure 7. The Organization of the Roman Legion.

Rome was expanding its territory by political moves after defeating a neighboring people by offering them Roman citizenship, tying them to the Roman state. Many agreed to their terms because of the fear of the Gauls. The ties that they formed made them stronger and better able to handle the next wars. Alfred B. Bradford even states that "tactically the Romans were sound; strategically they were brilliant; politically they were unique." (*With Arrow, Sword and Spear*, pg. 168).

Early Roman Republic – Rome's Rise to Power

Thirty years after their occupation of Rome, the Gauls returned. Rome faced the threat of the powerful tribes but held them back at the Anio River, taking care to also defend their territories as well as continue to expand their rule. In 338 B.C., they defeated the Latins, and some of the Latin cities became part of the Roman state, while others remained independent allies. By this time, Rome controlled central Italy and set their sights on Campania to the south. Once Capua and four other Campanian cities chose Roman citizenship, Rome turned to the last strongest power left in Italy, the Samnites. (*With Arrow, Sword and Spear*, pg. 168 - 169).

The Romans and Samnites were armed similarly, but as far as tactics were concerned, the Roman legion was adapted to the plain while the Samnites took to the mountains. A trap was set by the Samnites to lure the Roman legion and managed to capture them and starve them in to signing a peace treaty in 316 B.C. The Romans later ignored said treaty by forming alliances with the Etruscans north of the Samnites to invade them. Later the Etruscans broke their alliance with Rome and formed a new one with the Samnites, causing the Roman legion to fight on multiple fronts. This ended with multiples raids of Samnium, and in 304 B.C. the Samnites agreed to peace under Rome's terms. (*With Arrow, Sword and Spear*, pg. 169).

Rome's goal of controlling central Italy was complete through their use of the colonies, grants of citizenship and binding treaties, when they were faced with a new problem: the Gauls. The Gallic invasion caught the attention of the Etruscans and Samnites, and the three allies fought the Romans. In 290 B.C. they were able to defeat the Samnites and the Senones, the fiercest of the Gallic tribes, and expel the Gauls from Italy. (*With Arrow, Sword and Spear*, pg. 169 - 170).

The power that Rome gained from defeating the Gauls led the Greeks who lived south of Italy and the Adriatic to look to them for their protection instead of the Spartan colony of Tarentum. This colony did not take to well to that and insulted a Roman ambassador during a festival after attacking a small Roman fleet. They appealed to the king of Epirus, who was confident enough in his military tactics and assets that he agreed to aid them. His agreement was motivated by the hope he could convince these territories to sign citizenship under himself, as Philip and Alexander of Macedonia had done earlier on. (*With Arrow, Sword and Spear*, pg. 170).

Early Roman Republic – Rome vs. Epirus

Pyrrhus, king of Epirus, did not have much knowledge of the Romans and simply assembled his phalanx, cavalry, and elephants. The campaign began in 280 B.C. when the Roman consul made the first move against Pyrrhus with a battle at Heraclea. The night before the battle, Pyrrhus came to the conclusion that the Romans were not barbarians as he thought. That battle was won by Pyrrhus, and he intended to march on Rome, but found too few allies to be able to do so. Forty miles away from Rome, he turned back. He delivered his terms to Rome, which included a guarantee of Greek autonomy in return for Greek withdrawal from the Samnite, Lucanian, and Bruttian territories, but these terms were rejected by the Senate. In 279 B.C. another battle occurred at Asculum near the Aufidus River in which the Romans did not emerge victorious again, but Pyrrhus' next step was unclear. (*With Arrow, Sword and Spear*, p170).

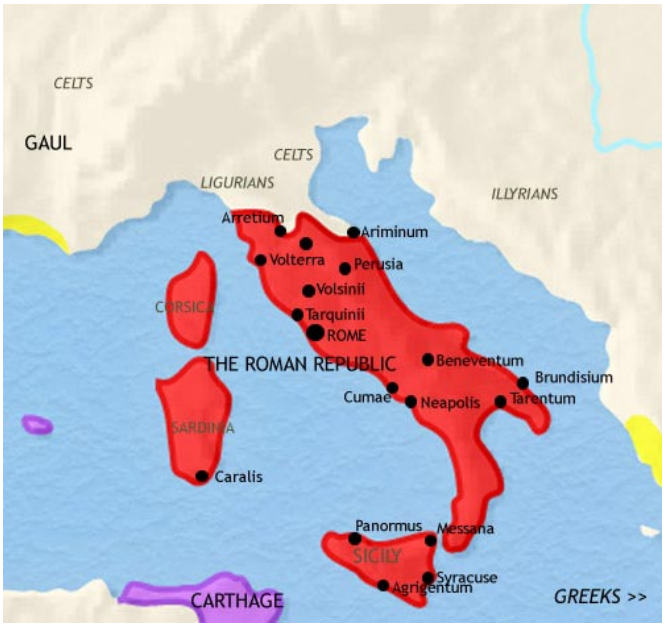


Figure 8. Map of Italy in 200 B.C.

Pyrrhus was invited to Sicily to help put it in order as the Carthaginians were launching an invasion. He offered Rome a truce that included that the Romans recognize Tarentum's territorial integrity, but was rebuffed when a Carthaginian admiral came to Rome and offered to blockade Pyrrhus in Tarentum and bring Roman troops to Sicily to fight against him there. The Romans accepted and Pyrrhus left for Sicily, leaving the Romans control of southern Italy. Pyrrhus gave up in Sicily in 275 B.C. and returned to Tarentum, his forces quite reduced and with no allies to aid him. He fought his third battle against the Romans at Beneventum, and no one came out victorious. When the second half of the Roman legion came, Pyrrhus withdrew back to Epirus with only a third of his original forces. (*With Arrow, Sword and Spear*, p171).

This victory led Rome to be able to do as they pleased in southern Italy, subjugating the native people, confiscating territory, and settling more colonies. In 272 B.C., Pyrrhus was killed, and Rome laid siege to Tarentum, which had been given a garrison to aid them when Pyrrhus had

retreated a few years before. Tarentum became Rome's naval ally, and the Romans left their own permanent garrison of their legion in the citadel to watch Tarentum and protect southern Italy. (*With Arrow, Sword and Spear*, p170).

With their increase in power and reputation, they received more and more requests for aid. In 264 B.C., Appius Claudius sent an advance party to Messana, which had been seized by an Italic people called the Mamertines, and forced the Carthaginian garrison there to leave. The Carthaginian commander did so, as he did not have orders to engage the Romans and was given the death sentence upon his return home. The entire Carthaginian army under the command of Hanno was sent to ally themselves with Hiero's Syracusan army and put Messana under siege. Thus began the First Punic War. (*With Arrow, Sword and Spear*, p171 - 172).

Roman Empire

Spectacula Gladiatorum

Since the beginning of time, many civilizations performed sacrifices in either public or private celebrations. The victims were presented to the gods as offerings for fertility and regeneration in this ancient rite. The Roman Empire took this practice to a higher level, evolving it from sacrificial combat at funerals to gladiator combat held in purpose-built coliseums holding up to 50,000 spectators! These spectacles of blood (spectacula gladiatorum) are estimated to have begun in the third century B.C. when, at the funeral of Brutus Pera, a historian of the empire, six slaves fought to the death in three simultaneous combats following Pera's will. In the next one hundred years, these games became a custom widely accepted in the *munera*, services to honor death, such that in 174 B.C. These funeral contests were held in Rome for the death of the famous politician Titus Quinctius Flamininus. The *munus* held in Flamininus's honor lasted three days and involved seventy-four gladiators paired against each other (Wisdom, 2001) (Kyle, 1994).

Figure 9. With a Turned Thumb an 1872 painting by Jean-Léon Gérôme portraying the cruelty of the games

The gladiator battle was an acclaimed sport and high source of entertainment. More and more people demanded deadlier and bloodier combats, and for this reason the sport was also used as a powerful political strategy. Wealthy romans and politicians saw the *munera* as opportunities to be remembered after life gradually making the games more outstanding and expensive. They held games in their honor and left arrangements for them in their wills as a testament to their existence. Julius Caesar, for example, used to sponsor gladiatorial games to win public support among other politicians (Wisdom, 2001).

Purpose-built grounds were constructed in the capitals to host the games, but the poor foundations and the number or spectators led to collapse of many of these structures and the death of many Romans. These accidents led to the creation of amphitheaters made out of stone. The Flavian Amphitheatre, later known as the Coliseum of Rome, being one of the first. These specialized structures were known as *arenas*, Latin for "sand", because the floor was covered with it, a material picked to absorb the blood of the combatants (Wisdom, 2001).

According to Donald Kyle, individuals would go to these events for multiple reasons: “The allure of violence and erotica, the expectations of punishment of certain participants, the admiration of skill and power, the involvement of gambling, or simply because it was a social main event.” (Kyle, 1994).

Recruitment

A man became a gladiator for various reasons, one of them being the thirst for an exciting life, wealth, and fame. In reality, gladiators were regarded as individuals of low social standards. Most gladiators were slaves bought by the gladiatorial schools or simply criminals condemned to die in the arena. Unlike gladiators, the *noxii*, or condemned criminals, didn’t receive training for battle. As criminals, they had lost their rights and their only way out of prison life was to be executed in combat. It is believed that criminals were sent into battle with weapons, but unarmored so that the battle became more of an execution. The battles in the arenas were deadly and vicious. In order to train a gladiator to triumph in battle, it was necessary to impose a harsh regimen of discipline and physical conditioning, to promote *virtus*, an ancient Roman value perpetrating courage. Some very skillful champions would win the support and admiration of true fanatics and become celebrities while others perished for mere entertainment. (Wisdom, 2001).

Life in the schools, just like battles in the arenas, was cruel. Besides the strenuous training exercises, the living conditions were those of a slave. They could be married and have children while living in the barracks, but were vigilantly watched by the guards, especially gladiators that were not free men training by their own will. Those who did not follow the rules were harshly punished, either by imprisonment or beating and lashing. The harsh treatment in the schools led to revolts and rebellions by gladiators against their masters. A famous example is the revolt of Spartacus in 73 B.C. when, enraged by the treatment by their master, a group of gladiators led a rebellion against their master in Capua (Wisdom, 2001).

The Artifact

Just like modern combatants, gladiators were classified by type. These categories were often made by the type of equipment they used in combat. The helm for a gladiator in the Higgins Armory Museum collection is believed to have been used by a type of gladiator called the *hoplomachus.* This type of gladiator was well known for his small round shield made out of bronze and resembling that of the Greek hoplite. He wore heavy protection for the lower torso and a *manica* or arm shield on his right arm. The

Figure 10. Gladiator Helmet HAM #

hoplomachus used a thrusting lance and a long dagger as his weapons of choice, another big resemblance to the Greek hoplite (Eckart Köhne, 2000). The helmet was probably highly polished and its crest ornamented with tall horsehair ending with a lion's head in the anterior part of the crest. The helmet is made out of bronze, and the remnants of mounts in the interior edges indicate that cheek-pieces and face guards were probably fitted (HAM 1129- Exhibit Information).

Probably the most famous of the gladiator categories and one of the common adversaries of the *hoplomachus* was the *Murmillo*, a heavy weight gladiator whose arms resembled those of a Roman soldier of the time. He used thick wrappings to cover his feet, a *manica* on his right arm, and a long oblong shield to defend himself but had no armor to protect his chest. His only weapon was the *gladius*, a short to medium sword used primarily for thrusting and also the weapon of choice of the Roman army. His helmet had an angular crest, usually decorated with a plume of feathers or horsehair (Eckart Köhne, 2000).

The gladiator games were not only a showcase of blood and violence, but served as a reenactment of victories of the Empire. It is no coincidence that the types of gladiators originated from existing types or warriors. The *murmillo*, for example, depicted a Roman legionnaire, and the *hoplomachus* resembled a Greek warrior. Battles between these two adversaries and other types of gladiators were used to reenact Roman victories and to advertise the control of the Empire over other civilizations of that time (Eckart Köhne, 2000).

Figure 11

Knightly Weapons

In the 1300s of Europe, it became glaringly apparent that the Feudal system was not a very efficient method of raising armies as it had been designed to provide the King with knights to defend the kingdom – not campaign for it. This led to increase in the need for professional soldiers as well as led to confusion with knights as many of them held fiefs from more than one lord and thus owed many allegiances. Since knights were a defensive tool to protect the kingdom, kings needed to hire professional soldiers which became costly as many times they were only hired for a short period of time. During this century, King Edward I of England began granting contracts to individual nobles and, later, professional soldiers to provide mercenaries to serve the king indefinitely and it became common, carrying on into the Hundred Years' War. An undesirable effect of these contracts during said war was that there was a formation of 'free companies' that were soldiers who were left unemployed at the end of a campaign that set out to look for a new paymaster or became brigandage. Often times these groups would march into an area, hold it hostage and demand ransom before leaving. (*Arms and Armor of the Medieval Knight*. p66 – 67).

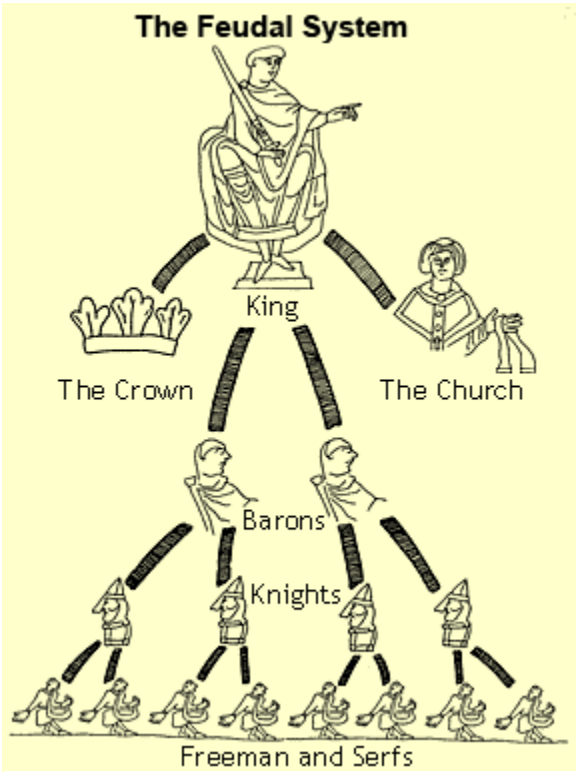


Figure 12. The Feudal System

The 1300s saw great political upheaval seen in the numerous costly and bloody wars such as the Hundred Years War between England and France, the troubles between France and Flanders, the struggle for the throne of Castile and the Great Schism of Italy. These battles during this demonstrated that knights were no longer the highest military power and could be defeated by infantry. In 1302 at the battle of Courtrai, Flemish infantry defeated the best knights

of Europe, the *puissant* chivalry of France and in 1314 at the Battle of Bannockburn 23,000 men picked by Edward II was defeated by 10,000 Scottish spearmen. (*Arms and Armor of the Medieval Knight*. p68).

Figure 13. Battle of Courtrai

The weapons created during this time were made to be penetrative and percussive in nature, such as the two handed axes, maces and swords that were used for thrusting and causing damage by force. The most dangerous weapon during the 1300s was the English longbow, which at a short range could penetrate even plate armor. Armor for the knights in this time was characterized by the increasing use of plate defenses for the body using materials such as latten (a brass-like copper alloy), whalebone, *cuir bouilli* and iron and steel. Knights were increasing interested in defending their bodies using various metals as the number of professional soldiers were used increased. This was due to the fact that professional soldiers did not expect mercy if captured and thus gave no mercy themselves on the battlefield. (*Arms and Armor of the Medieval Knight*. p68 – 69).

For head protection, the Great Helm was commonly used and was usually over a basinet and varied in its general form. By 1350, the helm was restricted to tournament use as it restricted movement of the knight's head and his breathing as well as weighing about 5 – 6 pounds. By around 1375, the helm had become so tapered that it formed an elongated pointed nose and the side and front of the helm extended downwards to almost rest on the wearer's shoulders and chest. This was to allow any weapons aimed at the head to slide off during a joust. (*Arms and Armor of the Medieval Knight*. p67, 71).

Another popular head gear was the basinet which allowed for a lifting face piece, small holes for air flow and a conical nose piece that covered the base of the neck, cheekbones and the apex of the skull with a main aventail. By the end of the 1300s, the aventail was replaced by plate defense. A final type of helm used during these times was the kettle hat

Figure 14. Basinet Helmet

which was popular among the poorer knights as it was easy to manufacture and obtain. (*Arms and Armor of the Medieval Knight*. p71, 73).

Throughout the 1300s, the most common form of body armor was a textile or leather garment lined with plates. By the late 1350s, effigies of knights were beginning to show the evolution of a single large plate protecting the upper chest accompanied by smaller plates to cover the shoulders. Guard chains were also often attached to the helm, sword and dagger and then riveted the breastplate to prevent their loss if a knight was disarmed. By the 1360s, this large plate had increased in size and covered the chest down to the diaphragm and the skirts of the armor were vertical rows of rivets in a cloth cover made of iron or steel. By the 1370s, the waist lames had disappeared to be replaced by a breastplate which rested at the top of the wearer's hips although this did not become common until the 1380s. (*Arms and Armor of the Medieval Knight*. 74).

Another form of body armor, a pair of plates was used, this also was commonly known as a coat of plates which was a development of the 1200s. This was often used to display the wearer's coat of arms. Knights also wore a surcoat that could be reinforced with oblong vertical plates that were riveted to the cloth and would reach the wearer's ankles and was usually tucked into a belt. During the 1300s, the surcoat began to shorten and by the 1340 had risen to knee level. Around the 1360s, Germany had stopped wearing them but the rest of Europe continued to use coat armor. For the duration of the 1300s, knights also still wore their hauberks under their armor but it had also been shortened by the 1350s to reach just below the hip level. (*Arms and Armor of the Medieval Knight*. p73, 77, 79).

Arm and leg defenses developed inconsistently with one another and show certain amount of local variation. During the 1300s, a metal plate covered the point of the shoulder (spaulder), the upper arm was protects by a rerebrace, elbow a couter, and lower arm a vambrace. Modern use is that vambrace is the entire arm defense, the upper and lower arms are cannons and the elbow is still a couter defense. A knight completed their arm defenses with gauntlets. By 1330, mail mufflers had disappeared and the new gauntlets were deep-cuffed cloth gloved plates with whalebone or clothe/leather gloves lining the inside of the plates. The most common form of gauntlets were hour-glass form consisting of a large plate shaped for the back and sides of the hand, constricted at the waist and

Figure 15 Vambrace Left. HAM 2797.g

flared to form a short cuff. The plate was embossed for the shape of the knuckles and base of the thumb and the gauntlet was completed by small overlapping plates to protect the fingers and thumbs and was stitched to an internal glove of leather or cloth. (*Arms and Armor of the Medieval Knight*. p79, 81).

Leg defenses were minimal at the beginning of the 1300s with knights wearing mail chausses and little or no additional defense. Sometimes they were worn with gamboised cuisses and cup-like steel poleyns and occasionally schynbalds or shin guards made of plates. After 1310, schynbalds were replaced by full and demi greaves. Up until 1340, gamboissed cuisses were still common but afterwards were replaced with globular poleyns. (*Arms and Armor of the Medieval Knight*. p81).

Knightly Training

A knights training began around the age of 7 year olds and it was not custom for a noble's son to stay in his home to train. The most common action was that the son was sent to a noble of higher rank and reputation, sometimes even to the King's court, in order to begin training. The boy would start as a page in which they would learn the basics of chivalry as well as to give the utmost respect and to revere their patron as their own father. The amount of loyalty that was instilled in a page to their teacher tied them together and was greatly sought after by those of higher nobility. If there were fathers that were inclined to keep their sons home, the King would sometimes demand that the boys be sent to his court. Their daily activities included playing, some reading, and singing, playing his accompaniments on the harp, backgammon and chess. He was also taught his prayers and to respect the Church and their religion. (*When Knights were Bold*. p1 – 4).

Figure 16. Page Training

A page also had to learn to serve others of the household and was at the beck and call of those who lived or visited their lords. The ladies of the household would teach them how to choose their 'lady love'; a woman of noble birth would be his inspiration and guide him on the path of chivalry. Outdoors, a page would be with his lord on the battlefield to help in any manner that he was able. A page was safe at battles because it was shameful and

disgraceful for a knight to attack a page. When not on the battlefield, the page would be training in horse riding, learning how to use the sword, lance and bow as well as how to swim, box and fence. The most important of his training was hunting and hawking. When the page reached the age of fourteen or fifteen, they became squires, another step towards knighthood. (*When Knights were Bold*. p4 – 7).

As a squire, more services were required and the exercises became more severe. They were required to continue serving the table but received more privileges such as being able to present the first or principal cup of wine but were never allowed to sit at the same table as his lord. Often, a knight's son could not sit with him until his son reached knighthood. After the evening meal, pages and squires would clear the hall for the night's activities and squires had the ability to join in the festivities. They also continued their lessons with the ladies of the household with their chivalry and choosing their lady loves. Each squire was also the "squire of the body" in which they became his lord's closet attendant. (*When Knights were Bold*. p9, 11).

Exercises became more severe for squires and required much more time. They learned how to survive in harsher conditions such as going without food or water for certain amount of time or enduring the hot and cold weathers with very little resources. Their weapons were much larger and heavier, such as the battle axe. Squires were also required to don armor and be able to move around. (*When Knights were Bold*. p10).

Figure 17 Knightly Training

On the battle field, while a page was only required to carry his lord's helmet, a squire was required to carry the shield and armor. They also had to aide in the most difficult duty – to array the knight in his armor with all its complicated fastenings. A squire was also to bear the banner or pennon on the knight they served. In the midst of battle, he was to supply the knight with fresh weapons if a knight lost his and to chase his lord's runaway horse if necessary. If he could supply a fresh weapon or catch his lord's horse, he needed to supply his own. Any prisoners taken were under the charge of the squire and if the knight was not doing well or taken prisoner,

a squire was required to try and aid or free him if he was able. If a knight was wounded, his squire was to help him most to a safer spot away from battle and if a knight died, his squire was in charge of ensuring that his lord received an honorable burial. (*When Knights were Bold*. p10 – 13).

There were two ways that a squire could be named a knight, either on the battlefield if there was little time or in a grand ceremony in times of peace. In order to be knighted, it needed to be done by the King or by another knight. A squire was knighted on the battlefield if he had shown great bravery that aided his lords' cause. When there was more time, an elaborate ceremony took place in which the squire would first cut his hair as a symbol of his devotion of God. This could be anywhere from a lock of hair to shaving their head completely. They bathed two nights before the ceremony to signify that they were purifying their body and was put to bed by those who were guiding him through the process. This signified the rest that he who was pure would enjoy in Paradise when it was his time. Even a knight's clothes held significance such as a white shirt or long tunic demonstrated that he was cleansed from all sins of his previous life. A red garment with a hood was placed over the white shirt or tunic to signify the man's readiness to shed his blood in God's service and finally a black coat was added to symbolize death and that it was reminder that the final destination for all. (*When Knights were Bold*. p14 – 15).

After 24 hours of fasting, the knight-to-be would spend a night in a church in a vigil of arms. This meant he knelt by his armor, praying and meditating the entire night. At sunrise, he would make confession to a priest then heard mass and partook of the Holy Sacrament. Later on in the day, he and his first went to the Church or Castle hall of his lord and gave his sword to the priest to have God bless it on the altar. He would then take a solemn oath to use his sword to defend the Church and protect widows and orphans then the priest would tell him his duties as a knight. Finally, the man would kneel before the lord who was knighting him and was asked questions about his intentions about becoming a knight. After answering, all the knights and ladies present would dress him in his armor and presented him with his sword last. The lord would then give him the accolade which was either placing a light

Figure 18. Knighting of a Knight

touch on the shoulder or nape of the neck with a sword or a hearty blow with his hand or clenched fist. All the knights present then repeated the vows they had taken at their knighting as the new knight said them for the first time. A priest would give a blessing to all and the ceremony ended. (*When Knights were Bold*. p15 – 16).

The assembly present would then proceed outside where the knight had to jump into the saddle of his horse without using the stirrups. Doing so would have embarrassed and shamed him before the lords and ladies around him. Once on his horse, he rode around the courtyard showing his new status through various demonstrations to everyone present. At this point, all servants and minstrels of his lord's house were also present because the new knight was required to give a gift to all in order to prove his gratitude for receiving his knighthood. (*When Knights were Bold*. p17).

The Pikeman

The pike is a spear-like polearm, ranging from fifteen to twenty feet long, with pikeheads made out of iron forged in different shapes (Fryer, 1969). It was useful as a defense from mounted units, as well as charges from infantry and it wasn't intended to be thrown unlike similar weapons. Since the early middle ages, armies relied upon a large number of pikemen. Their primary use as a defensive line made them invaluable and, thus, a standard unit in most armies (Webb, 1965).

Figure 19. The pikehead of one of the pikes in the Higgins Armory Museum Collection

In order to operate this weapon, a pikemen had to go through an extensive training because the length of the pike made it difficult to control. There were two main positions for handling the pike in a fight. In preparation for an attack against infantry, the pikeman would stand sideways, facing the direction of the enemy, holding his pike shoulder high, parallel to the ground with his right arm fully extended, and the left arm close to his chin (Number 14). The other position was mainly against an incoming attack of cavalry. This position consisted of leaning the body forward while dragging the right foot back, bending the left knee, planting the butt of the pike against the right foot, and grabbing the pike with the right hand. This position also led the pikeman to grab his sword with his right hand (Number 16) (Webb, 1965). Positions like this became an effective line of defense against incoming charges of enemy infantry and cavalry. This so called "porcupine" formation was another tactic where the pikemen were crucial in the battlefield, especially to protect musketeers from attacking opponents.

Figure 20. Basic Fight Positions for a Pikeman

The type of armor the pikemen used varied with time and place. There are frescos where the pikemen are depicted wearing full armor; however, there are records that show otherwise. Since armor was expensive, it may have depended on the wealth of the wielder, or of the state, but as Douglas Miller said: "we can safely assume that the pikemen wearing full armor made it to the front lines while those wearing little to none armor stayed in the center or the rear of the formation." (Douglas Miller).

The use of the pike and other polearms became popular to defend the slow loading musketeers from attacking cavalry. This strategy was the mastered by the Spanish and can be seen in their battle formation called "the tercio" or "one third" where, in a mixed infantry formation, the arquebusiers and pikemen mutually supported each other. The practical use of polearms ended with the development of the bayonet by the end of the sixteenth century, as every musketeer was now his own pikeman. By the second

half of the seventeenth century, polearms were mere signs of rank or used as ceremonial accessories, and largely vanished with many other such weapons with the development of better gunpowder arms.

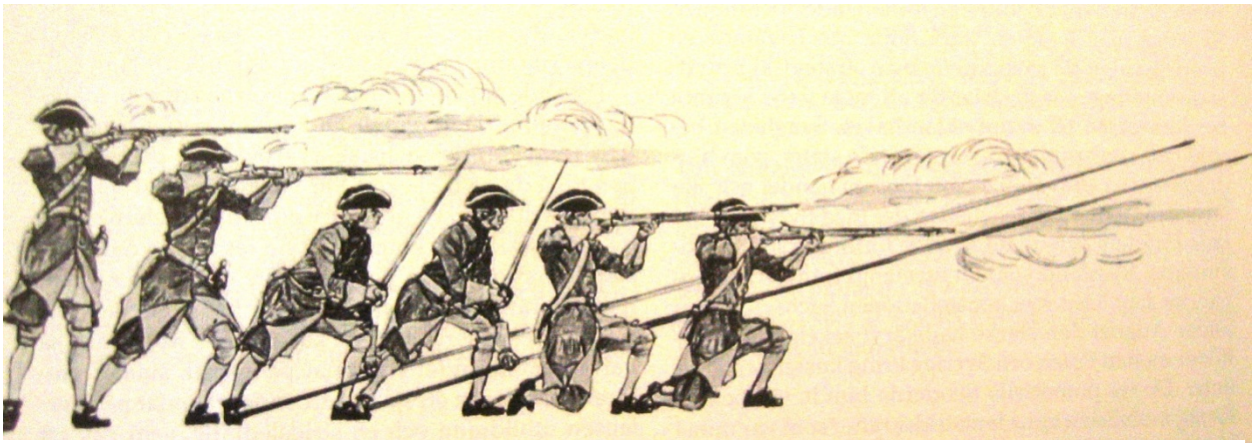


Figure 21. Pikemen defending musketeers

Sporting Arms and Armor

Staged combats have existed from early Roman times, one of the most popular being the gladiatorum, or gladiator combats. This tradition continued to the medieval era, but in the form of non-lethal contest called jousting. Appearing as early as the twelfth century, and regarded as training for war, the joust flourished as a sport (Bull, 1991). By the end of the twelfth century, King Richard I legalized these tournaments, and participated as a competitor himself. Quickly, these tournaments became a vehicle of personal glory and profit for those knights who participated. (Paddoc, 1988). Initially there were no regulations regarding the conduct of the participants of this sport. However, by the end of the twelfth century, the appearance of judges and heralds helped to keep order in the games. By this time, coats of arms began to identify families, and it was common by the end of the thirteenth century. The coat of arms was a useful way to recognize a knight in full armor, as the helmet covered the face, and identity, of the knight completely. As the games became famous, national trained warriors would fight for honor and fame, but many of them lost their lives in these exhibitions of skill. By the end of the thirteenth century, the safety of the combatant was addressed in order to safeguard the warriors life's, and protect them from injury. Lances with blunt ends were used, and the games were then addressed as "Joust-of-Peace."

By the end of the fifteenth century, the use of lances with crown-shaped iron head called "coronel" helped to reduce the probability of armor piercing. In addition, around the same time,

knights began to use specialized armors for the jousts. A knight was furnished with an armor that covered all of his upper body, the groin area, and leg armor protecting the leg facing the other knight. The addition of small wooden shields also became popular by that time. However, by the end of the fifteenth century, the use of “Renntartsch”, metal shields permanently bolted to the breastplate, became more prevalent. The accidental death of King Henry II of France in a jousting game in 1559 marked the rapid decline of these games, but the yearn for the Middle Age that many nineteenth century authors romantically detailed in their novels, revived these old games. In 1839 the Earl of Eglinton, Archibald Montgomerie, planned a monumental reenactment of these tournaments. The Eglinton Tournament was widely publicized and open to the public, with one hundred thousand spectators present the opening day. Participants spent a fortune in costumes, armor and equipment, to reenact the old pageants. Unfortunately, the event was a failure after rain halted the festivities (Karcheski, 1995). The armors used in these games by the participants were the original armors from the seventeenth century. The armor of a pikeman that rests in the collection of the Higgins Armory Museum in Worcester Massachusetts (HAM 360.a-e) may have been used in this tournament. It was purchased from a sale of armors from the Eglinton castle, and may have been forged at the beginning of the seventeenth century

Figure 22. Pike Man Armor HAM # 360.a - e

Rapiers and Short Swords

The Rapier

A rapier is a kind of slender sword that was primarily used in the sixteenth century for fencing and evolved from the Estoc, a heavy cross-hilted sword dating back to as early as the thirteenth century. Initially, it was a two-edged sword used for cutting and thrusting, but later it became a blunt weapon that was used only for thrusting. The rapier is considered to be the first sword designed exclusively for civilian use. By the sixteenth century, gentlemen wore it to demonstrate their status in society and also to defend themselves or their lady's honor. The term "Rapier" was first noted in a French document in 1474 and is believed to come from the Spanish word "espada ropera" or costume sword (Valentine, 1968).

Figure 23. Rapier sword with elaborated hilt guard HAM # 1705.1

Rapiers became a fashion dictated by style and decoration, the blades were generally made throughout Europe, but the ones made in certain areas of Spain, Italy and Germany became particularly well-known (Valentine, 1968). The vast number of rapier swords exported made them a fashion accessory for anyone that could afford it, increasing the growth in demand for these swords which led to the evolution of the rapier to the most commonly used, the Smallsword (Paddock, 1988).

The increasing civilian use of these swords led to the development and widespread interest in the art of fencing in the sixteenth century. Eventually, fencing schools were founded that allowed gentlemen to not only practice the sport but to learn the codes of dueling. By mid-sixteenth century, fencing had become so popular in Europe that several fencing masters evolved as experts in this field (Valentine, 1968).

One of the signature features of rapiers was their elaborate hilts. The hilt wards appeared in the early fifteenth century when swordsman learned that placing the finger over the *ricasso*, the part of the blade above the guard, gave them better control of the blade, especially when thrusting. However, this trick left the hand unprotected to attacks, which led to the introduction of finger guards, were simple iron rings, which were of special significance to the civilians using these weapons, since they didn't carry any type of armor for the hand (Valentine, 1968).

Figure 24. Swept-Hilt Sword for Munich Town Guard HAM # 2005.02-2

The hilt guards were locally equipped, which led to the innumerable styles that we encounter today. Over the sixteenth century loops and bars were added to the guards producing the swept hilts, which were often highly decorated. These combinations of parts were known as “arms of the hilt” and by the end of the sixteenth century presented complicated shapes in a combination of iron rings, loops, and bars (Wilkinson, 1970).

The blades were generally slender becoming narrower as they came to the tip of the sword. The length of the blade varied depending on the user, but was typically thirty to forty inches in length. The longer the blade, the more advantage the swordsman would get when thrusting and keeping the adversary at a distance. The base of the blade was generally thicker than the tip in order to allow the weight of the sword to be balanced (Valentine, 1968).

The swept-hilt sword for the Munich town guard in the Higgins Armory Museum (2005.02) presents the characteristics of a rapier with the swept-hilt and sharply tapered point but the wide blade at the hilt is characteristic of a military broadsword making it a crossbreed of the two. The blade wears the crown of Wolfgang Ständler, a bladesmith of southern Germany. The hilt still keeps the original bluing that protected it from rusting as well as adding color (HAM 2005.02- Exhibit Information). The sword was forged in the late sixteenth century or early seventeenth century a period of time where robust military swords started to being produced in large numbers (Karcheski, 1995).

The Smallsword

Figure 25. The hilt of a smallsword HAM # 1999.02.1

In the middle of the seventeenth century, rapiers evolved into smallswords, which were lighter and shorter than the rapier and heavily decorated. They evolved in France becoming more of a fashion accessory than a self-defense weapon and were regarded by the owner as “something beautiful but useful that would reflect his social position.” (Wilkinson, 1970).

Just like its predecessor, the shortsword was an effective dueling weapon. The blades with elliptical sections were common at the beginning of the seventeenth century since the edge of the blade was blunt making this weapon exclusively for thrusting. By the late seventeenth century, a blade with a wide top third, nearest to the hilt, and abruptly narrowed to the

point was introduced with the name of “colichemarde”. This design was probably adopted by swordsmen to parry while leaving the top of the blade narrow for efficient thrusting. It is common for the blade of a shortsword to never exceed thirty three inches of length (Wilkinson, 1970).

For the greatest part of the eighteenth century, these swords remained as a fashion trend for young gentleman, but its use diminished by the beginning of the nineteenth century. The hilts of these swords displayed less complicated patterns but we’re highly decorated with silver, gold and gems. By the end of the eighteenth century, the use of cut steel jewelry and jasperware in the shape of buttons and buckles as costume accessories was becoming a fashion. The English became masters of these techniques, applying it even to decorate the hilts of shortswords. The Higgins Armory Museum possesses a smallsword (1999.02.1) that is the perfect example of that unusual application. This sword forged by Matthew Boulton and decorated by Josiah Wedwood’s jasper plaquetes was both a costume accessory and a witness to the industrial history. Boulton and Wedwood were two of the leading figures in the Industrial Revolution. The sword is believed to have been forged in Birmingham and has a hilt that is brightly polished to resemble faceted diamonds. It is believed to be factory-made by Boulton since his workshops were among the first to introduce factory procedures. Only eight surviving swords or hilts with similar workmanship are known (HAM 1999.02.1- Exhibit Information).

¾ Cuirassier

Figure 26. French 3/4 armor for a cuirassier HAM #2585

The Higgins Armory collection includes this French three-quarter armor piece for a cuirassier, dating from 1610-20, made primarily of steel, and weighing approximately 64 pounds. The *cuirassier* was a heavy cavalryman named for his *cuirasse*, a heavy piece of torso armor and the main protection of any cavalryman from this time period. From the 1300s onward, the cuirasse also included a backplate, which was often made of multiple overlapping plates in order to increase flexibility.

The piece comes from an era when gunpowder was taking over the battlefield, and therefore it has several features that represent divergences from the medieval armor tradition in an attempt to counter the use of firearms, or at least to extend the usefulness of heavy cavalry in the presence thereof. Most notable is the piece's monolithic inflexibility. The pattern of overlapping plates came to be replaced during the 1500s by the older single-piece pattern, due to the influence of gunpowder (Blair 150). Only by having a single solid wall of steel could the breastplate possibly be strong enough to stop the penetration of firearms. The breastplate is also much thicker than traditional armor, and it is bowed in an arch shape to maximize the angle at which projectiles would hit it, making lead balls more likely to deflect. An earlier piece that would have served a similar function on the battlefield (2585) is shown at right for comparison. Accordingly, HAM 2585, dating from about 1525, weighs much less than the gunpowder-influenced piece—a mere 45 pounds. However, the later piece's legs are made of overlapping plate armor, allowing for increased flexibility and therefore greater maneuverability on the battlefield. The front visor of older pieces has also been eliminated, leaving a wide-open face and superior visibility. Both of these latter changes reflect an increasing complexity of battlefield tactics.

Additionally, the extent to which the newer piece covers the body is reduced. Greaves and sabatons have been removed from the design, while arm armor has been eliminated altogether below the shoulder. The purpose of these modifications is to offset the weight of the extra-thick cuirasse to whatever extent possible by removing as many parts that do not protect vital organs as possible; nonetheless, the weight of the armor has been made ever more

burdensome by the threat of firearms, while its protective ability has only been reduced. The attempts to minimize the protection of nonvital organs also reveals the trend away from medieval shock tactics, and the increased use of the lance and small firearms by cavalry in the Renaissance.

All of these factors, which are characteristic of armor from this time period when medieval-style warfare was taking its last gasp, are part of trends that eventually made body armor unusable. The weight of armor was increasing so rapidly that it became more of a burden than a help, and the returns it gave in terms of protection were not proportional to the incumberment. In the Renaissance arms race, new gunpowder technology was constantly being invented that was capable of piercing even thicker armor. The inflexibility and weight of the piece also effectively negated the rider's ability to engage in hand-to-hand combat, nor did cavalry units have the speed for tactical flexibility. The role of heavy cavalry was essentially reduced to that of a shock unit, charging in an oblique formation and trampling enemies underfoot by sheer mass. By the 1700s, mounted troops would forego armor almost altogether, and light cavalry would become a highly useful element of combined arms tactics due to its mobility and flexibility.

The Demise of the Nobility in Warfare

The progression away from heavy cavalry could be attributed just as much to societal changes as to technological or purely military factors. Throughout the Middle Ages, the battlefield had been dominated and commanded by the nobility in the form of armored horsemen, the knights. Command of an army and possession of luxuries such as a horse and armor were privileges acquired by status birth, and the modern system by which officers are appointed based on merit was entirely unknown. So ingrained was the European "caste" system in the medieval mind that knights would often trample down their own hordes of serfs in order to engage their social equals on the other end of the battlefield (*Men in Armor Singled Out*).

The feudal mentality remained with the nobility well into the 1600s (and to a certain extent until the overthrow of the monarchies), and the wealthy classes tried every possible means to preserve their position and resist the intrusion of those who would ascend through the ranks. Until the 1500s, the usual way for a nobleman to learn warfare was by first learning combat skills in his own home, then learning to apply them in live action under the personal guidance of an experienced commander. Under such a system, it was ensured that the nobility would always retain the dominant role in battle. With the balance of armies being made up of untrained and unequipped illiterate peasants, and such a heavy emphasis on tradition at the expense of innovation, it is little wonder that the biggest, heaviest, and most brutal troops of the era—the knights—would carry the day. No one had either the desire or the means to seek ways to counter heavy cavalry. By the 1300s and 1400s, however, this system was beginning to change.

Figure 27 In the Midst of Battle

However, with the spread of literacy, the revival of classical ideas about society and government, the ascendency of the merchant class, and the introduction of more advanced military technology spurned on largely by competing Italian states, the leader of a nation no longer had to rely on his noblemen to be good leaders in war. He now had the devastating weapon of education at his disposal. Commanders could be hand-picked on the basis of competence, although from a practical standpoint the system remained far from egalitarian. Perhaps more importantly, disorganized hordes of peasants were supplanted with trained and paid infantry units armed with pikes or halberds. These “pike squares” consisted of men standing shoulder to shoulder in perfect rows resembling a Greek phalanx and having the appearance of an impenetrable hedge of pikes (sketch of the siege of Pavia, above). Such discipline and

weaponry put infantry at an advantage over cavalry in melee combat for the first time since antiquity.

The nobility's initial response to the new circumstances was ridicule: in a belligerent society conditioned to accept leadership by birthright and a tradition of combat handed down from master to pupil, it was difficult for more conservative-minded persons to adapt. by the mid-1500s, many young noblemen were seeking to reconcile their status with the times by studying warfare academically and remaining open to tactical experimentation. The conservative reaction was not kind: in 1549, the Italian thinker Pietro Aretino wrote to a young nobleman:

> *"I consider it of little importance or none that Your Excellency has set yourself to studying treatises and compendiums on the art of war. A man of your talent and your valor should rather have a great captain for his instructor....You should study and consider things military in actual warfare and not in the classroom (Hale 226)."*

Nonetheless, military academies designed to help train officers of noble birth began to appear all around Europe as an attempt to preserve the meaningfulness of the knightly class while accepting modernity. The first full-fledged military academy, still socially restrictive, was John Nassau's *Scholas Militaris* at Siegen, Westphalen, founded 1617 (*Hale 225-242*).

But nothing could save the noble armored horseman. The spread of education and formal training significantly devalued the advantage the nobility were afforded by status, and the two most effective anti-cavalry weapons, the pike and the handgun, were tactically combined to reduce cavalry to a role player in the cat-and-mouse game of combined arms warfare. The pitched battles of the Middle Ages in which heavy cavalry had the opportunity to bludgeon enemies in the open field gave way to skirmishes and sieges as the primary setting of combat. European warfare had permanently been dismounted and moved to the ground.

Firearms

Historical Background.

The sixteenth and seventeenth centuries were a period of cultural revolution in Western Europe. The intellectual pulse of Europe took a reversal of trend when modern secular Humanism replaced the theocentric worldview of the Middle Ages; the Protestant Reformation came into full swing in the second half of the 1400s, tearing apart the ecclesiastical and monarchical fabric that had unified Medieval civilization and defined its purpose. Technological advancements in seafaring opened up contact between relatively barbarous Europe and the rest of the civilized world, allowing the West to accumulate degrees of wealth never before seen in any civilization.

Along with the extreme advances in technology and wealth came a dramatic change in the nature of warfare: the Military Renaissance, starting about a century after the cultural Renaissance, and lasting from about 1500-1650. Europe, which had aforetime been arranged into various principalities and feudal territories, was now fractured into large and aggressively competitive countries with centralized systems of government more capable of organizing military operations and equipping soldiers in the field in a more methodical manner. Aside from heavy cavalry, namely, the knights, who were the decisive factor on the medieval battlefield, warfare of the Middle Ages primarily consisted of small bands of minimally equipped peasants fighting as a means of fulfilling fealty to a remote lord: rather, battles consisted in large-scale clashes of professional soldiers—often mercenaries—fighting with the best weapons available and using complex tactics.

Gunpowder on the Renaissance Battlefield.

The most important factor in the whole struggle of the Renaissance battlefield was the introduction of firearms. Gunpowder was likely introduced to Europe from the Far East by way of the Mongol invaders who were present in the Middle East and Eastern Europe during the thirteenth through fifteenth centuries, although its presence was barely felt on the battlefield before the mid-1400s, when gunpowder artillery played a major role in the final battle of the Hundred Years' War at Castillon and in the siege of Constantinople, both in 1453. The very first use of gunpowder by Europeans is much disputed, but it was certainly sometime in the early

1300s. Whatever its origins, its destructive power was quickly realized, leading to a cultural backlash—statesmen, churchmen and writers often discussed the use of gunpowder, seeking either to condemn it as diabolical or morally justify its use. Part of the reason Europeans were so eager to (correctly) ascribe credit to other cultures with the invention of gunpowder was that they thus felt themselves absolved of the guilt of having created it themselves (Hail 235).

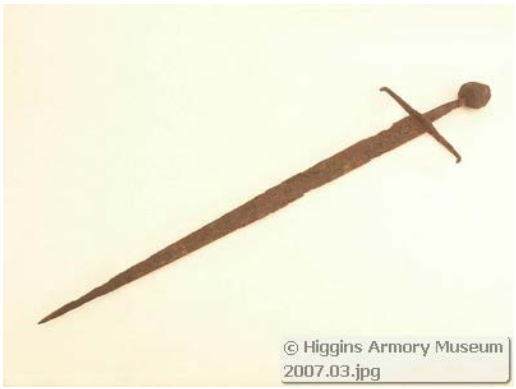


Figure 28. Castillon Sword HAM # 2007.03

Infantry firearms did not actually make a significant impact until the 1500s, but the first combat-effective handgun, the arquebus (or *hakenbüchse*), quickly became the focal point of Renaissance warfare, along with heavy artillery. The bulk of infantry consisted of pikemen and halberdiers until the invention of the bayonet, but the melee weapons increasingly served merely to protect the entrenched arquebusiers from cavalry charges, while the firearms became the weapon of choice for offensive combat.

Italy, the site of numerous clashes between French, Swiss, Spanish and local Italian forces in the late fifteenth and early sixteenth centuries, became the proving ground of the arquebus in combat. At the beginning of the conflict, Swiss tactics, which revolved around massive pike squares not dissimilar in their usage from the Greek phalanx, dominated the battle field, winning a notable victory at Novara in 1513 over a French army which included artillery and medieval-style heavy cavalry. Nine years later, a combined French-Swiss attack on Spanish and Imperial German arquebus-supported troops at Bicocca met with disaster, as the Swiss pikemen and French cavalry, impeded by Imperial


Figure 29. Battle of Pavia 1525

earthworks, were cut down by arquebus fire. For the first time, handguns had decisively won a battle. At the Siege of Pavia in 1525, the Spanish and German Imperial combination of arquebusiers guarded by pikemen routed the French army so decisively that the French troops exchanged their crossbows for firearms (Brooks 64).

The Arquebus.

Figure 3 Arquebus HAM # 2002.03

The term *arquebus*, meaning "hooked gun," a term of uncertain origin, generally refers to any of the relatively lightweight handheld matchlock weapons that succeeded the hand cannon on the battlefield. Hand cannons were cumbersome, prone to failure, vulnerable, immobile, heavy and inaccurate, and generally had poor range and a slow rate of fire, making them undesirable in comparison to a crossbow or longbow. Moreover, the arquebus had the distinct advantage of having a stock, allowing it to be aimed with precision and helping to control the recoil, whereas the cumbersome hand cannon was simply squeezed between the arm and side. Arquebuses also included a sight-line to improve aiming, which would not have been possible could not the gun have been held at eye level. So versatile was the weapon that the term "arquebus" continued to be used to describe any handheld firearm up through the English Civil War, after the arquebus proper had fallen out of use (Blair 46).

Another major improvement in the design of the arquebus was the firing mechanism—the first matchlock. The "match" was a smouldering flax cord soaked in saltpeter, and was the means by which the gunpowder was ignited. The hand cannon required the infantryman to manually insert the match into the firing mechanism, making the weapon cumbersome and equally dangerous to both the enemy and the man firing it. The matchlock, on the other hand, provided a trigger mechanism, obviating several of the disadvantages of the hand cannon. The arquebus could be held with both hands (as opposed to requiring one hand to hold the match), which improved the weapon's accuracy and portability (Blair 342).

The Higgins Armory collection possesses an arquebus barrel as the oldest gunpowder piece in its collection. The piece, which weighs 40 pounds, would have been propped up on a forked stand in battle, as were most early firearms, due to its great weight. This particular piece was eventually converted into a light cannon. The barrel's external octagonal shape indicates that

the piece was formed by welding eight strips of metal together, reflecting rather poor manufacturing technique compared to later firearms, since the welding seams are always liable to rupture when firing. On the upper side of the breech is the touchhole, through which the chamber would have been ignited, and a gunsight is on the front tip. The piece dates to about 1500, with its origin in Germany or Switzerland, making it an example of the sort of weapon that would have been used in battles such as Bicocca and Pavia.

The Musket.

Figure 30. German Musket HAM # 460

During the last half of the 1500s, the arquebus was gradually replaced by the musket. Like the arquebus, the musket required a forked stand and was fired using a matchlock mechanism. Its primary distinguishing characteristics were its longer and wider barrel, which improved accuracy and firepower and allowed for heavier balls. It was also substantially more efficiently built. Besides these improvements, the musket had essentially the same limitations as the arquebus. However, it was this weapon that finally spelled the death of traditional battle armor by virtue of its greater armor-piercing ability. The musket was the main infantry weapon of Europe for a century, until it was replaced with lighter weapons. The musket is not to be confused with later firearms that inherited the same name (Blair 348). Higgins Armory owns a German musket (460) from the late 1500s to early 1600s. The weapon weighs a mere 12 pounds 4 ounces (compare the 40-pound arquebus barrel).

Other Artifacts.

<u>Puffer (wheel-lock holster pistol):</u>

Figure 31 Puffer Wheelock Firearm HAM 3 1997.02

This pistol was used in the Trabantengarde of Elector Christian I of Saxony. Such holster weapons became a common feature of cavalry units by the 1600s, although their usefulness against other armored cuirassiers would have been very limited. Dated 1588, this piece is an example of a wheel-lock, a firing mechanism more advanced than the matchlock. In place of a constantly burning rope, the wheel-lock ignition used a spring-

loaded wheel in contact with pyrite to generate sparks (Blair 279). Such a mechanism had two distinct advantages: first, with the perpetually smouldering match eliminated, the danger of accidental explosions was eliminated; and second, the weapon could be fired in wet weather. Wheel-lock weapons such as these could be used by cavalrymen, who could not carry the smouldering rope of the matchlock. The main disadvantage of the wheel-lock was its high cost of production; as a result, matchlocks continued to be the most common firing mechanism until the popularization of the flintlock in the early 1700s.

Pair of wheel-lock holster pistols:

Figure 32 Pair of Wheelock Pistols HAM # 1997.04 a & b

These pistols are essentially a later form of the above, dating to about 1650. This particular highly decorated pair, one of the finest pieces in the museum's collection, probably belonged to a high-ranking officer.

Wheel-lock carbine:

Figure 33. Wheelock Carbine HAM # 2004.01

This artifact came from the Trabantengarde of Wolf Dietrich von Raitenau, Prince-Archbishop of Salzburg, about 1590. Carbines of this period would have been used on horseback (Blair 113). The light weight of more developed firearms and the ending of the dependency on forked stands brought about such new and tactically interesting possibilities as mounted musketeers, conceptually a revival of the medieval horse-archer, although mounted archers had not been a part of medieval European warfare.

Western Asia - Ottoman Turkish Panoply

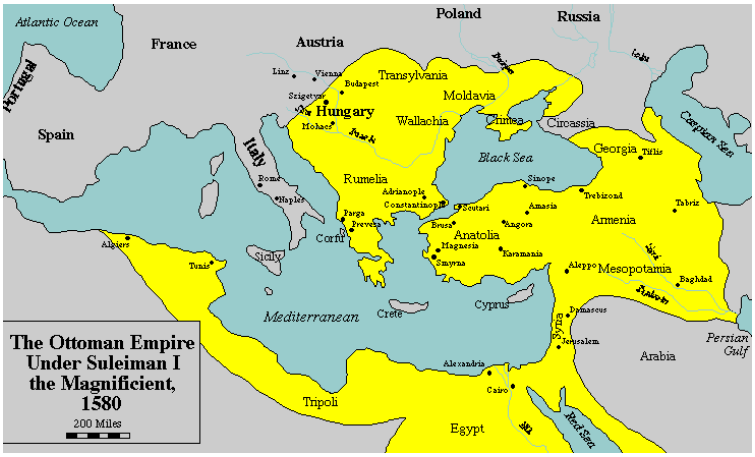


Figure 34 The Ottoman Empire

The Ottoman dynasty, originating in central Asia Minor during the time of the Seljuks, expanded its territory into a formidable empire during the 1300s and 1400s, conquering their first territory across the Dardanelles in 1356 and becoming a feared power in Europe. Ottoman territory eventually reached the Danube, and Sultan Mehmet II captured Constantinople in 1453, sending shockwaves throughout Christendom. Selim I and Suleiman the Magnificent brought most of the Middle East, North Africa, and large portions of Eastern Europe under Turkish control by the 1560s. The Ottoman Sultan thereafter assumed the role of caliph of all Islam.

The Ottoman Empire utilized its subjects' economic productivity to support its vast military. Throughout the 1500s, the standard practice for ensuring the stability of the Sultanate was for the Emperor to execute all his brothers once he assumed the throne. Islam within the Empire was institutionalized as a branch of the government led by the Grand Mufti. The Sultans established a system of Islamic law known as *Qanum*, which played essentially the same role as Shari'a law. The majority of Christian subjects, although initially well-treated because of their Romano-Byzantine heritage, which the Turks sought to emulate, were very gradually relegated to a social role equivalent to serfdom, their male children being taken from their families at the age of seven and recruited into military service, especially for the army's elite infantry unit, the Janissary corps.

From the reign of Suleiman's successor, Selim II, onwards, the Ottoman Empire entered into a gradual decline, although its culture continued to bloom. The unprecedented oppression perpetrated by the Ottoman rulers and the economic instability caused by constant warfare led to

instability in the armed forces and internal revolts. The decentralization of the Empire left a power vacuum for the rise of regional rulers known as *ayan*. Religious offices became hereditary property that was often sold. Nonetheless, the Empire produced notable figures in literature, art, and architecture, and introduced the printing press to the Middle East. Gradually, however, the source of the Empire's economic strength was transferred to the non-Muslim merchant population, especially to Jewish immigrants fleeing persecution in Europe. As a result, relations between Muslims and non-Muslims became increasingly strained.

The failure of the second Ottoman siege of Vienna in 1683 marked the turning point of Ottoman dominance in Eastern Europe. In 1774, the Russian victory in the Crimean War resulted in the Tsar being given the role of protector of the Christians of the Turkish Empire. Lagging behind European technology and unable to grow out of its medieval systems of government and warfare, the Ottoman Empire was finally dissolved by the victorious Western powers at the close of World War I in 1918 (Craig 479-81).

Figure 35 Turkish Bow Case Cover HAM # 2394

Three exemplary Ottoman pieces exist in the Higgins Armory collection. One, a 1600s bow cover, possibly originates from Ottoman-ruled Mamluk Egypt. The piece is unusual in that it is made of iron. The Arabic inscription is typical of Islamic arms. However, this particular inscription may actually be a Persian poem about a heroic warrior.

Another piece is a 1700s composite bow (2409). Composite bows are made of several layers of different materials. The steppe nomads, of whom the Ottomans were descendants, were experts at the art of bowmaking. The composite structure gives the bow tremendous firepower in proportion to the draw weight. The bow is recurved, meaning that when strung, it bends the opposite way from the direction of the "C" curve

Figure 36. 1700s Composite Bow HAM # 2409

in its unstrung state. This design also contributes to the bow's firepower, and the design is only possible with composite bows, which alone have the flexibility to bend so far.

Figure 37 1700s Yataghan (Saber) HAM # 3567.a

Finally, this steel 1700s yataghan, or saber, was one of the chief melee weapons of Ottoman armies, the design being imported from central Asia. The inscription reads, "Made by Akhmed, friend of Muhammad, who put his trust in God, the Creator of His servant Muhammad. Please God, be of help and give blessing to the owner of this, and make the tip of it blessed." The yataghan is almost exclusively a slashing weapon, and is ideal for use on horseback.

Africa – Sudanic Panoply

Survey of the Cultures and History of the Sudan.

African is perhaps the most understudied region of the world in historical and social disciplines. It will therefore be of benefit to briefly explain the various peoples of Sudanic Africa and their histories.

The Sudan is the large belt of land stretching across Africa south of the Sahara Desert and north of the central rain forests, from Ethiopia to West Africa. It is separated from the Arab-Islamic cultures of North Africa by the Sahara Desert, the belt of grassland between the Sudan and the desert being called the Sahel. Despite this immense geographic barrier, the Sudan has historically been a crossroads of African, Islamic, and European cultures, as is reflected in their arms and armor. It is no surprise that this cultural intermingling produced some flourishing African civilizations, often overlooked by the mind of the West—Byzantium and Persia are examples of more well-known fertile cultures that grew up as a result of the same conditions. Arab, Turkish and European traders often journeyed down the Nile or along the African coast to do business, giving rise to trading centers such as Timbuktu.

The Sudan was home to peoples with complex agricultural methods as early as the first millennium B.C., and the use of Iron entered into Africa simultaneously in the West by way of the Berbers, being mastered first by the Nok culture, and in the East by the Ethiopian Empire of the Meroitic period, which had a flourishing iron industry in the sixth century B.C. By the second century A.D., agriculture had become the dominant way of life in most regions of the Sudan. The first millennium also saw the rise of the first major kingdoms in the Western Sudan, such as Ghana, Gao, and Kanem.

Figure 38. Mali Empire during the 1400s

After the collapse of the Empire Ghana in the 1200s, the Western Sudan became dominated by the Mali Empire, whose rulers, having inherited Islam from their predecessors, were brought into contact with many foreign cultures by Muslim traders from the Middle East. During the 1400s,

the Empire of Songhai, centered around the cities of Gao and Timbuktu, became the wealthiest and most powerful state on the African continent under the expansionist policies of the emperors Sonni Ali and his successor, Askia Muhammad. At the same time in the Eastern Sudan, Christianity was gradually being displaced by Islam in the Nubian kingdoms of Maqurra and Alwa along the Upper Nile. By 1500, the officially Muslim sultanate of Funj controlled the Upper Nile (at the location of the modern state of Sudan), and uniquely represented Arabic culture in sub-Saharan Africa until being overrun by an Ottoman Turkish invasion in 1821.

Gradually throughout the 1800s, European colonial interest in Africa grew immensely, leading to the scramble to carve out African "colonies" in the 1880s. In the Sudan, "reformed" Islam came to be seen as an alternative to European materialism, giving the Sudanic peoples something around which to rally, a sort of revival movement within African Islam. In 1881, Muhammad Ahmed proclaimed himself the Mahdi, or awaited deliverer, and successfully rebelled against Ottoman rule in northern Sudan, creating an independent state that lasted until 1899, when a British invasion conquered the nation from his successor (World Civilizations).

Figure 39 Songhai Empire during the 1800s

Sudanic Weapons and Warfare.


Figure 10 Central Sudanic Bornu Warriors on horseback

The primary traditional weapon in the Sudan is the sword. Sword-making shows the clearest influence of foreign cultures in the Sudan through trade: many West African tribes, such as the Hausa, often carried blades that had been manufactured in both Christian and Muslim Spain and even as far away as Germany, local smiths often imitating the crescent seal of Toledo on their handiwork. Weapons manufactured in Timbuktu imitate their European counterparts so closely that

it is often difficult to tell them apart. The Hausa, in fact, believe themselves to be descended from blacksmiths. Iron is often used as currency due to its great value as a weapons material. Central Sudanic Bornu warriors, mounted on horseback, typically wore a combination of quilted armor and Arabian-imitation chainmail, often with an iron cap-helmet. The introduction of stirrups from Arabia greatly enhanced Sudanic cavalry. Cavalrymen typically carried double-bladed lances, spears, and javelins, which were very effective at piercing chainmail. Spear blades were often highly decorated with calligraphic inscriptions. In the Upper Nile, the fighters in the Mahdi rebellion were characterized by their medieval-European style longsword, called the *kaskara*, with which they were unequalled in war until the arrival of advanced gunpowder weapons. Chiefs and emirs often wore chainmail over quilted armor, and rounded helmets with nosepieces (Nickel 17-26, Spring 33-46).

Metalworking.

African metalworking technique had some fundamental differences from Eurasian, and deserves comment. Iron was the metal of choice, but bronze and copper were also used because they can be worked cold, if heated and chilled beforehand. Bronze, however, requires great experience to be worked, and is also brittle. Iron smelting technology never achieved temperatures over 1200 deg. C, which is sufficient to turn iron into a paste, but not into a liquid. As a result, iron could never be fully purified. The great advantage of lower smelting temperatures is that the weaponry, after hammering, is denser than usual, producing flexible and springy blades. The impurities resulted in a metal that was effectively a form of steel. After the basic shape of a sword was made, ridges or grooves would be hammered into it to improve its structural integrity. Decorations were often tribal identifications or status symbols.

Smiths have traditionally been considered outcasts in the Sudan because their craft is associated with magic, and they live outside the village. However, the smith is also feared for his ability to manipulate fire, perhaps testifying to his importance within the group as a whole (Fischer 9-11).

The Panoply.

The most notable item in the collection's panoply is the iron and brass mail coat (397). The coat dates from the 1500s, making it much older than the rest of the panoply. It is the kind of coat that would have been worn by a mounted warrior, and is thus slit at the legs in both front and back. The coat is likely originally Mamluk or Persian, with later Sudanic alterations.

Figure 41 Sudanic Panoply Iron and Brass Mail Coat HAM # 397

Figure 42 Islamic Kaskara HAM # 2416.a

The rest of the panoply dates from the 1800s. The shield (not shown here), or *kalkan*, is probably of Turkish origin. The radial iron bars give a great deal of structural support while minimizing weight. The kaskara (2416.a), although it resembles a European longsword, is actually also Islamic in origin. This is the typical style of early Islamic weapons, the famous scimitar being a later introduction from central Asia. The blade is probably an original product of Africa, the crescent-moon shapes on the blade imitating German blades. The helmet (3050) is originally probably Ottoman, possibly as old as the 1400s, but the adjustable nosepiece is a later modification.

Figure 43 Ottoman Helmet HAM # 3050

The collection also includes a spear (78) from the 1800s, made of iron with brass inlays. It is an example of a typical Sudanic cavalry spear. The engraving on the blade is *thuluth* script, an adaptation on Arabic, often found on Sudanic weapons and bearing verses from the Qur'an—another adaptation from Islamic culture, where weaponry is often etched with calligraphic verses (Spring 78-79).

Figure 11 Sudanic Cavalry Spear HAM # 78

Eastern Asia

Japanese Samurai

The Far East is known for producing some of the world's finest warriors: the samurai. These legendary warriors, born in old Japan, were known for their use of the sword and firm loyalty to their master. The word samurai, meaning "those who serve" started to be used in the 9th to 11th century, but the story of these warriors can be traced as early as the beginning of the Imperial period. The samurai began as tribal warriors, born out of the need to expand their land following orders of the early emperors who at that time were the chiefs of their clan. Regarded as gods, these chiefs formed coalitions with neighbors to defeat rivals and conquer new land. The amount of land a tribe owned was crucial to the survival of the group and in Japan land was scarce. The samurai were born out of this struggle for land since they were nothing but farmers that raised arms to protect and conquer new land for survival (Turnbull, 1982).

Every Samurai followed a code of ethics that was born in the seven hundreds and was later called *Bushido*. The code dictated that "in war or in peace a Samurai was expected to serve his lord, show him ultimate commitment and follow a martial spirit by achieving military expertise; he had to be committed to duty and have courage to abandon his life in battle or through ritual suicide if necessary" (Deal, 2007).

Arms and Armor

Arms and armor of the Samurai were made in highly elaborate processes to achieve perfection and deadliness in the battlefield. Despite the various types of arms and armor, most of them remained uniform in design and followed similar processes for creation (Deal, 2007).

Compared with the relatively early end of European armor after the introduction of gunpowder, the use of armor in Japan came to an end in the late nineteenth century when the feudal regimen came to an end (Metropolitan Museum of Art New York, 1915). Japanese armor is very different from its European counterpart in that it emphasized mobility. It was made primarily with overlapping iron plates and leather plates reinforced with iron or steel held with silk or leather laces making it twice or thrice lighter than the European armors (Metropolitan Museum of Art New York, 1915) (Oscar Ratti, 1991).

The size of the plates depended on the part of the armor where they were going to be used. Larger plates were used mostly for the chest, shoulders and the loins, smaller plates were usually laced together to resemble scales and were used all over the armor to protect those placed where large plates couldn't be used. All these pieces were laced together to create a highly mobile garment where the implementation of

scales not only created an armor that was hard to penetrate by arrows and sword strikes but also was easier to operate with (Oscar Ratti, 1991).

Figure 45. Samurai Armor HAM # 3144

These armors were also highly decorated, usually depicting shapes and colors that were used to distinguish the rank of the warrior who was wearing it and also to identify the family and the clan of the warrior. The pattern of the armor's lacing distinguished its type and, after the sixteenth century, also identified the rank of the warrior. For example, a tight and elaborate lacing would be used by a samurai of high rank and position. The use of an elaborated *kabuto* or helmet was typical of a high ranking samurai who would wear it along with full body armor and a metal mask while leading his troops on top of a horse. The lieutenants and the lower rank soldiers wore a similar armor but made with simpler materials, according to their rank, and fought on foot (Oscar Ratti, 1991).

The armor for a samurai in the Higgins Armory Museum (HAM 3144) is believed to be made in the late eighteenth century and is made out of leather, brass, iron and silk, materials that were common in armors made in Japan's Middle Ages. It is believed to be crafted in the time where armor with these materials became obsolete for defense since Japan was going through a period of peace, but were still produced for their ceremonial significance (HAM 3144- Exhibit Information).

The *kabuto* was the most decorated part of the armor as it was intended to catch the eyes of the enemy and denoted the wielder's rank. Like the armor, it was made of different iron plates which then were polished and decorated with various materials. The neck guard or *shikoro* was fastened to the *kabuto* and was mostly made out of metal plates held together by leather or silk braids (Thomas Louis, 2008). After the fifteenth century the rank of the warrior was denoted by the number of laces in the neck guard (Oscar Ratti, 1991).

Figure 46. The Kabuto in the form of a sea-conch shell HAM # 2973

The *kabuto* in the form of a sea conch shell in the Higgins Armory Museum collection (HAM 2973) is a masterpiece sculped with a brim texture like a ray-skin. It was made in 1618 by Nagasone Tojiro Mitsumasa Saku, one of the best armorers in the Shinto period. With the original laquer removed, the complex assembly of this triumph of metalworking becomes visible (HAM 2973- Exhibit Information).

Figure 47. Japanese Katana HAM # 1060

For the Japanese, the sword marked the beginning of his life as a warrior and sometimes his unfortunate end. All warriors, regardless of rank, were trained in the arts of the sword and if a samurai ever wanted to rise in rank he would have to master this art by devoting time to pursue excellence with many masters (Oscar Ratti, 1991).

The samurai carried two swords and this pair was called *daisho.* The famous katana, which was a long curved single-edged sword, was the primary fighting weapon, the short sword called the *wakizashi,* was also used as a secondary weapon or as the samurai's final instrument for suicide. These swords cutting power and sharpness was also legendary, the secret of this was the resistance laid in the construction of these swords. The swords were externally hard but soft on the inside. This construction was achieved by a process of forging that was mastered by Japanese swordsmiths for centuries and created a flexible sword with a razor sharp blade (Oscar Ratti, 1991). For a *katana*, the length of the blade started at two feet and the grip of the swords was always long allowing a two-handed use (Bull & North, 1991). Both swords were carried on the belt using a sash or a belt.

Figure 48. Japanese Wakizashi HAM # 2290.1

The *katana* and the *wakizashi* in the Higgins Armory Museum collection (HAM 1860 and 2290.1) are swords that were forged using the the highly complex process mentioned above. It involved folding different types of steel into multiple layers, then tempering the metal to achieve the perfect balance of flexibility and durability (HAM 1860- Exhibit Information).

The combination of the *katana* and *wakizashi* was developed by samurais to be used on foot. There are sixteen varieties of sword blows mastered by the samurai, each with their own name, some of them requiring extreme skill and a life time of mastery. These moves were divided into two groups the *kiri* or the techniques of thrusting and the *tsuki* or the techniques for thrusting comprising moves for counterattack and offensive (Oscar Ratti, 1991) .

Mughul India

Figure 49. Pakistani Mail Head Defense. HAM # 891

An important group of artifacts displayed at the Armory are those that represent the Mughul Dynasty. There is a mail shirt thought to be from the 1700s, a Pata (or Patta) from the 1600s – 1700s, a Jamadhar from the 1700s and a mail headdress called a Kulah zirah from the 1800s. Mail armor was an important piece of the equipment as they were able to stop many different types of attacks, although they weren't as effective against piercing weapons.

Figure 50. Indian Pata or Patta. HAM # 1549

The *Pata* (also spelt *Patta*), known as a gauntlet sword, was invented and favored by the Marathas, a people of India. This sword has only been seen in the areas of Marathan influence, including among the Muslims, Sikhs, and Paj peoples. The hilt had padding internally to reinforce the user's grip as well as to reduce the force of impact. The blade is long, flexible, regularly tapered, straight, made of steel and most often double-edged. These blades are generally of European make – mostly Italian and Spanish origins. The gauntlet covers the arm almost to the elbow and is usually elaborately decorated with various animals such as tigers or dragons and very rarely have gems displayed. The blade is attached to the gauntlet hilt by a pair of seatings that are riveted to the face of the blade down both sides. These were kept in wooden sheaths that were covered with green, red or blue velvet. (*Indian Arms and Armor* VII. p61 – 65).

There is an iron strap hinged to the upper end of the sword that allows it to be fastened around the arm causing the grip to be at a right angle with the blade. This grip inhibits a user's ability to move his wrist, and the weapon was generally used by the cavalry as a lance due to its length. The *Pata* is held by the stronger hand through a loop on the sword with the back against the metal, and grasping the bar in the user's fist. This means that the muscles in the forearm and upper arm are being used instead of the wrist. (*Indian Arms and Armor* VII. p62 – 63).

Figure 51. Indian Jamadhar. HAM # 2391

The *Jamadhar* is also known as a punching dagger and is

generally found only in India. The handle is made up of two parallel bars that are connected by two or more cross pieces. These bars sheath the hand and part of the arm of the wearer. The blade is always double-edged and straight, although there are a few variations where the blade is curved. The length can be from a few inches to three feet long. The blade area near the hilt, or *ricasso*, is generally embossed for decoration. The dagger may be plain, partially or fully decorated with various engravings. As can be seen from the design, it is generally used as a thrusting weapon. (*Indian Arms and Armor* VII. p163 – 166).

The Mughul Dynasty was founded at the end of the 1400s by Babur, a member of the cultured Timurid elite, who was strongly influenced by the Iranian military tradition, although he was of Turco-Mongol origins. Babur managed to conquer a portion of Afghanistan, then moved onto Northwestern India, under the direction of Iran, and mainly fought to benefit his family. (*Mughul India 1504 – 1761.* p3 – 4, 7).


Figure 52. Emperor Babur

His first armies consisted of Turkish, Mongol, Iranian and Afghan troops and their main strength was their superior discipline and tactics that he had observed and adapted from his first Uzbek enemies. The elite cavalry used horse armor and some used the match-lock musket. Baber combined ancient military tactics with the modern tactics of his time that won him many battles. He would have archers on horseback antagonize their foe in the ancient manner, followed by his musket wielding horsemen supported by their horse-archers on their flank. (*Mughul India 1504 – 1761.* p7 – 8).


Figure 53. Mughul Army

Baber's good fortune did not carry over to his son Humayan, whose armies were driven into Afghanistan at one point, but during his reign a military evolution occurred, in which the best of the Central Asian traditions were kept and combined with tactics from their Indian enemies. Humayan's son, Akbar was considered the greatest Mughul ruler out of the three men. He tolerated

all religions and even tried to unite his Muslin and Hindu subjects under his own religion called *Din Ilahi* or 'Divine Faith'. (*Mughul India 1504 – 1761*. p8).

Akbar attempted to reorganize the army and their means of pay by regularizing officer ranks with the idea that all officers should start at the lowest possible grade and be promoted through their own effort and merit. This way of organizing the men was unfavorable to the troops and often did not work properly. There were 33 *mansabs* or officer ranks that were, in theory, appointed by the current ruler, with the first three ranks reserved for princes. Each grade was expected to maintain a certain number of horses and various other animals according to how far they had progressed, meaning those of higher rank were expected to maintain more animals than those of lower rank. There were various other obligations and changes to their means of payment that were certainly more complex than today's organization of the military. (*Mughul India 1504 – 1761*. p8 – 9).

Cavalry was the most important aspect of an army, and under Akbar it was divided into four sections. The first section was comprised of the elite *ahadi* or "gentleman troopers" who were the highest paid and most elaborately equipped, though many had yet to receive *mansab* (officer) ranking and needed to be under the authority of a senior nobleman. Their main duties included being aides to the Emperor, carrying important messages, and guarding the palace. (*Mughul India 1504 – 1761*. p10 – 11).

Figure 54. Mughul Cavalryman

The next section of the army was the *dakhilis* or supplementary troops, who were raised in their position and paid by their individual states. There were some *dakhilis* who were under the direct command of the Empower, called the *Wala Shahi*, consisting of men who followed him while he was a prince. They were under the command of various *mansabdars*, and the Emperor assigned some of these troops to serve under officers who were not permitted to recruit their own followers. Earlier on in Mughul India's history, one fourth of the *dakhilis* had matchlocks while the rest were comprised of archers or carpenters, blacksmiths, water carriers, and pioneers. (*Mughul India 1504 – 1761*. p11, 13).

Following the *dakhilis* were the *tabinan,* who were soldiers recruited personally by the *mansabdars.* Their training and equipment was determined by their *mansabdar*. This led to their training and equipment to vary as it was determined by the priorities of the various *mansabdar*. Instead of loyalty directly to the Emperor, the *tabinan*'s loyalty was directly to the *mansabdar* who recruited them. The final set of troops in the army did not have an official name, but were the irregulars that were left by various autonomous or tributary chiefs who would aid the Emperor infrequently. (*Mughul India 1504 – 1761.* p11 – 12).

Under Akbar, the ancient way of checking the quality of the troops by a horsebranding system called *dagh* was reinstituted. This prevented men from selling their horse and serving as infantry as many troops were poor peasants but horses were required as cavalry. On the horse's right haunch the imperial brand was placed, and on the left was the *mansabdar*'s personal brand and, at certain time times, there was a verification or *tashiha* of the men and their horses. During this process a detailed history was taken of the man's appearances and family history. (*Mughul India 1504 – 1761.* p12).

Since the actual training was determined by the individual *mansabdar*, not much is known about it. What is known is that the recruits had to pass vigorous fitness tests and horsemanship tests. Based on the fact that they heavily armored their horses, their training shows that the Mughuls valued strength and endurance over speed. Some horses were trained to walk or jump forward on hind legs to give a rider the height needed to attack a war elephant. Also a warhorse also had to be able to stop in its tracks and wheel around on its hind legs, which aided it in battle. (*Mughul India 1504 – 1761.* p12 – 13).

The infantry was not as prestigious as the cavalry but important nonetheless. It was made up of ill-armed peasant or townsfolk levied by the local Muslin *mansabdar* or Hindu *zamindars.* The only professional part of the infantry was the section that had matchlockmen. While matchlocks were preferred, they were also armed with swords (such as the pata), shields, assorted spears, daggers (such as the Jamdar), bows, and sometimes crossbows. The infantry's recruitment took place in the lower Ganges Plain, Bengal, the foothills of Raralpindi, and later on in the newly conquered territories in central and southern India. By the 1500s, recruits were coming from the deserts of Bulchistan as archers and camelback cavalry. During Akbar's reign, many groups of people were considered infantry including the *Khidmatiyyahs*, special units of

guards that were supposedly recruited from thieves and highwaymen, *mewiahs*, running messengers from Rajasthan, *chelahs*, royal slaves, *Urdulegis*, a unit of armed women who guarded the Imperial Harem, and various others. (*Mughul India 1504 – 1761*. p13, 15).

Figure 55. War Elephant carrying warriors

Another aspect of the Mughul army was its war elephants, which were most characteristic of armies in the area. A majority of the elephants were females that were used to carry baggage and pull guns, while a small number of males were trained for fighting. One of the main functions of war elephants was to provide rallying points, platforms to display the army's banners and give the commanders enough height to see what was going on in the battlefield, even though they were vulnerable targets high above everyone else. Elephants were important because they were hard to kill, but were easily driven off if intimidated enough. Akbar abandoned the old belief that it was unlucky to breed elephants in stables and raised them in various provinces under his rule. At the age of ten, these elephants were trained to be accustomed to gunfire and were then used in battle. Some years later, armored elephants even carried small cannons. (*Mughul India 1504 – 1761*. p15).

By the 1600s, various provinces were beginning to rebel against the Emperor and their troops' fighting skills soon surpassed those of the troops based as the center of the empire. They were beginning to pull away from government control. Europeans who had visited India noted that the Empire's loyal troops were brave but undisciplined and liable to panic. There was also jealously among the commanders, which led to decreasing loyalty to the Emperor. It is thought that the true problem was in the complexity of Akbar's military structure. His successor, Jahanger, attempted to simplify the structure, but in reality made it worse. When Shah-jahan came to power, there was a significant difference between the size of the army on paper and in reality. (*Mughul India 1504 – 1761*. p18).

The differences in the reported numbers and the actual size of the army was due to the fact that the senior officers were lending each other troops to increase their numbers before inspections or were rounding up any untrained men and mounted them on all available ponies. By 1630, Shah-jahan was able to determine the true size of the army and changed the official

numbers to match. He also reduced the officer salary to only pay for part of the year instead of a full year, and since the competent officers were being paid the same as incompetent ones, he also came up with a system to distinguish between them. (*Mughul India,* p19).

During the late 1600s, Aurangzib faced the Hindu Marthas, who favored the pata. By the end of his reign, the campaigns against the Marthas had broken them financially and the army fell apart. After his reign, the army was in units that were maintained by great noblemen for their own political rivalries and recruitment was sparser than before. By the 1700s, people of humble social rank were able to easily rise to real military power. (*Mughul India 1504 – 1761*. p19).

Conclusion

During the Pre-Qualifying Project (PQP), as preparation for the video documentary, the team (originally four members) researched two topics, Progression of Arms and Armor from Ancient Greece until World War I, and Comparison of Arms and Armor from Asia and Africa, using artifacts from Higgins Armory Museum. After research was conducted through the first term of the Interactive Qualifying Project (IQP), the team narrowed the subject down to the impact of firearms from their invention during the Renaissance to the end of traditional arms and armor. The script for the documentary reflects the main points of early firearms history gathered from our research as well as information on various Higgins Armory Museum artifacts.

The audio content includes narration from a member of the Worcester Polytechnic Institute theatre group, original sound effects, and creative commons period music. The visual content contains film from previous projects as well as new clips of reenactments of firearms and interviews. Animations were also utilized to better convey the concepts of the mechanics of firearms, a process which involved modifying existing animations of triggers by adding additional parts such as the match cord, perspective, and visual effects. The team is proud to have expanded on a piece of history that has yet to be explored before by previous IQP groups that opens up ideas for both the Higgins Armory Museum as well as future IQP teams.

Having access to previous teams' work allowed this team to spend less time on formatting proposals and the report and also gave insight into what the group would need to gather, since previous teams had only touched on the rise of firearms and decline of the traditional armored knight. Style and layout of previous research documents, scripts, and plans of work were a major influence on the material compiled by this team. Unfortunately, while there were many useful images and reenactments from previous IQP teams in the database, this team was unable to use much of it, since previous work was centered on the Middle Ages and the armored knight. Their work was a useful reference for understanding the production procedure of this group's video, including lighting, use of still images, interviews, and narration.

This video documentary, while using previous work as a template, has opened up new doors for future IQP teams. This is the first documentary to make use of modern animations in order to describe how certain mechanisms functioned. Second, previous documentaries had only used male narrators, whereas this team utilized a female voice to tell the story of firearms.

Tasks were divided based on each member's abilities and preferences, not only in the actual research, but in the production of the video documentary as well. Each member worked individually and would later consult with the rest of the team when needed. While the team had an online site to collect the information, use of it was not very frequent. We certainly encourage future teams to make use of this resource, as it may help in organization and communication.

During the PQP, there had originally been four team members, but due to complications one member removed himself from the team, and the original topics had to be revised to accommodate. The group members had never worked with each other before and had to learn each other's styles and efficiency while conducting the research. Only one member of the team had previous experience with video and sound recording and editing footage. If there are team members who are not proficient in these areas, we suggest that future teams schedule a training session with Jim Monacco from the ATC to avoid hiccups that we encountered later on in the production process. While it was difficult to proceed with only three members, we are still confident and proud about the video we produced.

Along with the previously made recommendations, the team has several other suggestions for future teams. The ATC is a great resource for filming and sound equipment, but having a knowledge of how to use the equipment properly is just as important as testing everything before an actual shoot. Whether a piece of equipment may function correctly is irrelevant if the team member in charge of the actual shooting of the video does not know how to use the camera and vice versa.

Organization and communication are incredibly important, as well, in order to produce the desired assignments each week of the project. Although many do not want to step up to lead a group, it would be useful to have one person who directs the group, assigns tasks and schedules meetings for the group to stay on course. This team was put four weeks behind without proper communication and organization of the tasks. Also, an individual must be aware of his or her own schedule and be able to ask for help with a task from another teammate.

We hope that our IQP will give a foothold for future teams to expand on the idea that medieval history neither ended nor started with the armored knight, and that the Higgins Armory Museum may also expand their collection and expertise to incorporate the story of the firearm and the Renaissance into that of traditional armor and the Middle Ages.

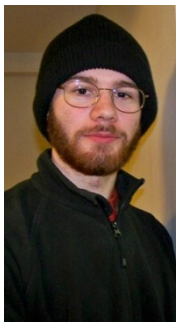
Appendix A. Team Biographies

Jacquelin A. Blair

Jackie is a born and raised Worcesterite and a member of many different organizations that contribute back to the community. While at Worcester Polytechnic Institute studying Biology, she is also a counselor for the Office of Diversity Program's Math and Science Technology Engineering Program for high school students, Secretary for Hadwen Park Congregational (HPC) Church's Christian Education Committee, College workshop coordinator at HPC and student worker at the WPI Office of Financial Aid. She researched Ancient Greece, Early Roman Republic, Knightly Weapons and Mughul India for the project.

Fernando Martell

Fernando Martell is an international student of the class of 2012 at Worcester Polytechnic Institute. He is a Computer Science major interested in developing the technologies of the future. He was mostly involved in the video development part of this project. His hobbies are playing with his PlayStation 3, Operating Systems and Management Information Systems. Currently he is the Webmaster for the Management Information System Association and is working in developing a biomedical device for Advance Body Sensing, LLC.



Nicholas Roumas

Nick Roumas is a student of chemistry at Worcester Polytechnic Institute, class of 2012. He is an enthusiast of history, and especially of foreign language study and traditional Eastern ecclesiastical chanting. He speaks German as a second language and has a reading knowledge of Koine Greek. In the project, he researched firearms, the three-quarter cuirassier piece, and the Turkish and Sudanic panoplies.

Appendix B. Documentary Credits

A Film Produced by:

Jacquelin A. Blair

Fernando Martell

Nicholas Roumas

Faculty Advisor:

Prof. Jeffrey L. Forgeng

WPI-Higgins Armory Museum

Narrated by:

Anika Blodgett

Music:

Jacquelin A. Blair

Fernando Martell

Nicholas Roumas

Filmed by:

Jacquelin A. Blair

Fernando Martell

Nicholas Roumas

Performers:

Steve Colonies

Richard Colton

Hunter Heinlen

Lisa Pearson

Bob Reed

Jennifer Reed

Renie Foote

Special Thanks to:

Springfield Armories

CT Iannuzzo

George Morgan

Lisa Pearson

Images Courtesy of:

The Higgins Armory Museum

Produced in Association with:

The Higgins Armory Museum

&

Worcester Polytechnic Institute

Appendix C. Documentary Script

Narrative	Video Component
At the end of the Middle Ages, new technologies were transforming European society.	Image – European Society http://www.iill.net/italian-renaissance
The printing press was breaking the Church's monopoly on learning; oceangoing ships were bringing wealth into Europe's cities, tilting the economy away from the farming estates of the feudal nobility.	Image – Printing Press http://www.gis.unbc.ca/courses/geog205/lectures/historyofcart/index.php Image – Christopher Columbus's ships http://encyclopedia.edwardtbabinski.us/wiki/index.php/Christopher%20Columbus Image – Berner Chronik Morat
But perhaps most powerful of all was a new technology that would revolutionize the face of battle as Europe moved into the Renaissance.	Clip – Armored Knight walking down hallway in HAM
Where once the armored knight had dominated the battlefield a new force was starting to break through the power of the knights: the force of gunpowder.	Image – Freydal Dagger Clip – Firearms being fired (Sound effect of gunshot)
Early black powder was made from only three ingredients: charcoal to burn, saltpeter to provide Oxygen, and Sulfur to keep the mixture burning. Black powder has to be kept completely dry—a little bit of moisture can keep it from burning.	Interview?
Historians believe that gunpowder made its way to Europe from China around the time of the Mongol conquests during the 1200s.	Image – Chinese Rockets http://fathertheo.wordpress.com/2010/10/08/archaeological-sites-in-british-columbia-other-dates/ Image – Chinese explosion http://kaleidoscope.cultural-china.com/en/10Kaleidoscope8482.html
By the late 1300s, gunpowder weapons had become a standard feature of European armies.	Image – 1400s Firearm Battle
The main handheld firearm was the hand cannon. As the name implies, the weapon was little more than a small cannon, mounted on the end of a staff for easier handling.	Image – Bellifortis Hand Cannon Image – Wallhausen Musketeer 1615
The gunner ignited the gunpowder with a length of smoldering cord called a match. Manipulating this lit match cord made the hand cannon difficult to use, and dangerous to the	Clip – Match Cord

gunner as well as to the enemy.	
The weapon was also weak on power, accuracy, and reliability. By the 1400s, large cannons were becoming powerful enough to break down castle walls, but handheld firearms couldn't pierce armor except at very close range.	Image – Folger Feuerbuch Cannon Image – Battle of Nancy
The first combat-effective handgun came into being in the late 1400s. Known as the arquebus or "hooked gun," this weapon had a sturdy wooden stock that allowed it to be aimed more precisely and helped to control the recoil when fired. Another improvement in the arquebus was the ignition system, called the matchlock.	Image - Diagram Arquebus 1 Image - Diagram Arquebus 2
The matchlock was a trigger mechanism that applied the match to the gunpowder, freeing the arquebusier's hands to control the weapon. The trigger lowered the burning match cord into the flash pan causing the gunpowder in the pan would set off the gunpowder in the barrel. This gunlock allowed for improved accuracy, though the weapon could still only fire 2 or 3 times a minute, and the match performed poorly in wet weather.	Animation - Matchlock Image – Matchlock Musket Image – Matchlock Musket1 Image – Matchlock Musket2 close up Image – Matchlock Musket2 Image – Matchlock Musket 3.1 Image – Matchlock Musket 3 Image – Matchlock Musket 4 detail Image – Matchlock Musket 4 Image – Matchlock Musket 5
The greatest danger to the arquebusier was the cavalryman. The arquebus was still fairly weak against armor: an armored knight was safe only 50 yards away from a line of arquebusiers. Since the knight could cover this distance in under 10 seconds, the arquebusier could only get one shot off before the cavalry came crashing in on him. To fix the problem, armies protected their arquebusiers with large numbers of armored pikemen.	Interview? Image – Pikemen protecting Musketeers
The pike was a long spear, ranging from fifteen to twenty feet in length.	Image – Pike 483
The pikemen could be arranged in a porcupine formation to hold off the cavalry, allowing the arquebusiers time to reload, pouring fire into the knights at close range.	Image – Holbein Pike
Tactics like these were used to deadly effect in battles like Pavia in 1525, where Italian foot soldiers slaughtered the flower of French chivalry, capturing the French king Francis I.	Image – Battle of Pavia http://commons.wikimedia.org/wiki/File:Battle_of_Pavia.jpg Image – Battle of Pavia 1 http://www.gettyimages.com/detail/51241434/Hulton-Archive

Firearms became even more effective in the late 1500s with the introduction of the musket, a more powerful and accurate version of the arquebus that could pierce plate armor at even greater distances. The power and accuracy of this musket required a longer and thicker barrel, making the weapon so heavy that the musketeer needed a forked rest to support it. This example from the Higgins Armory is over 5 feet long and weighs more than 12 pounds.	Clip – Matchlock Musket Image – Matchlock Musket Image – Matchlock Musket1 Image – Matchlock Musket2 close up Image – Matchlock Musket2 Image – Matchlock Musket 3.1 Image – Matchlock Musket 3 Image – Matchlock Musket 4 detail Image – Matchlock Musket 4 Image – Matchlock Musket 5
The increasing power of firearms forced cavalry to adapt their armor, giving up protection on the arms and legs in favor of heavier protection on the head and chest. This French cavalry armor from the early 1600s weighs 63 pounds, about the same as a medieval knight's armor, but it offers no protection to the arms or lower legs. This breastplate has had a reinforcing plate riveted to the inside, offering extra protection against firearms, but substantially increasing the weight.	Interview?
Clients insisted on having their armor tested, or "proofed," against firearms. As muskets became more powerful, bulletproof armor had to be made extremely heavy: this breastplate weighs a punishing 24 pounds, much too heavy to wear on the march: it could only be used in siege operations, where the soldier did not have to move around much in it.	Interview?
Firearms were tilting the battlefield in favor of cheap, low-paid infantry, putting the armored horseman increasingly at a disadvantage. The matchlock mechanism required the use of both hands and could not be used on horseback, but European inventors, among them Leonardo da Vinci, were trying to develop a mechanism that would allow a horseman to use firearms.	Image – Wallhausen Harquebusier Image – Leonardo Di Vinci's wheellock diagram (needed)
By the late 1500s, craftsmen were producing a new ignition system known as the wheel-lock. Instead of a burning matchcord, the wheel-lock used a spring-loaded wheel scraping against pyrite to generate sparks, in a mechanism comparable to a modern lighter.	Animation - Wheelock
When the wielder pulled the trigger the striker-	Clip – Wheelock Shot

arm holding the pyrite would drop onto the wheel creating sparks that ignited the gunpowder in the flash pan.	
Cavalry were issued short wheel-lock firearms like this carbine and this pair of pistols from the Higgins collection The wheel-lock was safer than the matchlock and also allowed the weapon to be fired in wet weather, but it was expensive and easy to break. Many surviving examples were ceremonial weapons issued to personal bodyguards, like this pistol for a soldier of the bodyguard of the prince of Saxony.	Interview? Image - Wheelock Carbine Image – Wheelock Carbine breech Image – Wheelock Carbine closeup Image – Wheelock Carbine mark Image – Wheelock Holster Pistol 1 Image – Wheelock Holster Pistol Image – Wheelock Rifle Image – Wheelock Rifle 1 Image – Wheelock Rifle 2
At the same time, gunpowder's shockwaves were spreading to other parts of the world. The Emperor Babur founded the Mughul dynasty in India during early 1500s thanks to his skill in exploiting the new technology.	Image – Emperor Babur http://www.indiapicks.com/Indianart/Main/MP_Mughal.htm
His Central Asian cavalry were used to shooting bows on horseback, and they had little trouble adapting to firearms; the Mughal army also mounted small cannons on armored war elephants to create living tanks.	Image – Mughul Army http://collections.vam.ac.uk/item/O9732/painting-the-victory-of-the-imperial/?print=1 Image – War Elephant http://civilianmilitaryintelligencegroup.com/?p=357
But the most dramatic impact of firearms was in Japan. Arquebuses were introduced by European traders in the 1540s, and the Japanese quickly began manufacturing their own improved versions.	Image – Japanese Matchlock1 Image – Japanese Matchlock1 details Image – Japanese Matchlock2 Image – Japanese Matchlock2 details Image – Japanese Matchlock3
It was the great warlord Tokugawa Ieyasu, the unifier of Japan, who first realized the potential of the new weapon. In 1575, Tokugawa used his guns decisively at the battle of Nagashino. The opposing warlord, Takeda Katsuyori, was laying siege to Nagashino Castle when Tokugawa approached with an army that included over a thousand arquebusiers.	Image – Tokugawa Ieyasu http://www.fresno.k12.ca.us/divdept/sscience/japan.htm Image – Battle of Nagashino http://animerulezzz.org/Animepedia/Others/5/img/Battle%20of%20Nagashino.jpg
Tokugawa used an innovative strategy that won him the battle: he deployed his arquebusiers behind a stream, and built wooden stockades in front of his troops to slow down the enemy cavalry, making them easy targets.	Image – Battle of Nagashino 1 http://www.vhinkle.com/japan/nagashino.html
Tokugawa also trained his soldiers to take turns firing: after the front row of arquebusiers had fired, they would step behind	Image – Battle of Nagashino 2 http://warandgamemsw.devhub.com/blog/516022-samurai-armies-i/

the second row, who would fire a second volley, allowing the troops to maintain rolling gunfire on their opponents. Tokugawa finished off the surviving enemy cavalry with spearmen who were mixed in with the arquebusiers, similar to European pikemen.	
After Tokugawa became Shogun of Japan in 1603, he and his successors banned firearms except in a few licensed arsenals. The Tokugawa shoguns feared that gunpowder weapons were a threat to traditional samurai society and might be used to start a rebellion. Firearms would not become a significant part of Japanese armies again until the late 1800s when Japan re-opened contact with the outside world.	Image – Japanese Matchlock1 Image – Japanese Matchlock1 details Image – Japanese Matchlock2 Image – Japanese Matchlock2 details Image – Japanese Matchlock3
Tokugawa's suspicions about firearms were borne out by events back in Europe. In the late 1600s, European armies replaced pikes with bayonets, a short blade that attached to the end of the musket. Now every musketeer could serve as his own pikeman, and the modern infantryman came into being.	Image – BL MS Royal 16 G IX Pike Formation Image – Battle of Eutaw Springs 1781 (bayonet) http://fusilier.wordpress.com/2007/01/page/2/
At about the same time, the older matchlock ignition was replaced with the flintlock, which created sparks with a sharpened flint striking against a steel surface. Before firing the wielder would cock the hammer containing the flint. When the trigger was pulled the flint would strike a metal piece to expose the pan and creating sparks that ignited the powder.	Animation – Flintlock Image – Flintlock half-stock Image – Flintlock Pistol 3655 Image – Flintlock Pistol 3657 Image – Flintlock Pistol 3694 Image – Flintlock Rifle Image – Flintlock Ridle 1998.04.1
This made the musket far more reliable, while improving metal technology allowed the weapon to become lighter, no longer requiring a rest. By 1700, armor had given up the arms race: armor that could stop a bullet was too heavy to wear in battle, so soldiers gave it up entirely except for a few specialized and ceremonial uses.	Clip – Flintlock Shot
The changing military technology brought social revolution in its wake. The power of the old feudal aristocracy was based on the power of the knight, trained since childhood in the arts of hand-to-hand combat, and using an expensive horse and armor that only a nobleman could afford.	Image – Goth Forschungsbibiothek Chart Image – Oxford Bodl 264 59r Battle Image – Oxford Bodl 264 86r Battle
Now an ordinary farmer or laborer could be	Image – Farming

trained for battle in a matter of weeks, armed with a cheap, quantity-produced firearm. It became increasingly difficult for the rulers of Europe to impose their will on the people who made up the backbone of their armies. During the 1600s, England twice overthrew its own king with armies based on these footsoldiers, establishing in 1689 a Bill of Rights for its citizens.	http://www.corbisimages.com/Enlargement/PL6634.html Image – English Troops http://greatestbattles.iblogger.org/Renaissance/06_English.htm
A hundred years later, American colonists would throw off English rule using the same firearms technology, and France would have a Revolution of its own, abolishing one of Europe's oldest monarchies.	Battle of Bunker Hill http://sandyspringsrotary.org/eNewsletter_10212010.php
The age of the knight in shining armor, and the feudal order he represented, had once and for all fallen in the face of this socially explosive technology.	Image – Full suit of armor (from Great Hall?) Clip – Weapon shot (Matchlock, Wheelock or Flintlock) [sound effect of gun]

Appendix D. Original Project Proposal

WORCESTER POLYTECHNIC INSTITUTE

Progression of Armor from Ancient Greece to World War I

An Interactive Qualifying Project Proposal

Jacquelin Blair, Fernando Martell, Nicholas Roumas

06/14/2010

Introduction

This WPI IQP group will research the arms and armor following the progression from Ancient Greece, Roman Republic and European Medieval Armor to the more modern version of armor that was created during World War I. While following this vein in history, the group will also be comparing European designs to the designs of Asian, Middle Eastern and African armor at the larger points in history. The team will be demonstrating these observations by developing a 12 – 14 minute video-documentary to be presented at Higgins Armory Museum as well as a research document that encompasses said topics.

The first topic will focus on Ancient Greece to the European Middle Ages that will encompass four main subtopics. Since there are four separate regions and times to observe, the historical, military, social and technological aspects will be focused on. The first stop will be Ancient Greece and their use of bronze and wood in their armor. Following Ancient Greece will be the End of the Roman Republic and the Beginning of the Roman Empire and their ability to use and adapt both Greek and Celtic armor. The third subtopic begins with the Dark Ages which encompasses the fall of Imperial Rome and the Crusades and the origins of the traditional medieval armor. The section ends with the look into the European Middle Ages where tournaments and more decorative armors were used.

Keeping on the same vein, the second topic will center around armor from the European Early Modern Period, or the Renaissance, to WWI divided into four main subtopics all focusing on incorporating historical events, social lifestyles, military tactics, and technological advances. Beginning with the European Renaissance and the development of firearms, this section will move through the Modern Era with the decline in armor and ending with the development of armor in WWI, focusing on John Higgins and his prototype helmet inspired by medieval armor.

The third topic will target West Asian and African arms and armor. Four distinct cultures will be examined. First, Arab Islamic arms and armor will be discussed, followed by the similar Persian and Turkish systems. Finally, an exploration of arms and armor from across Africa will be made. With each region or culture will be a discussion not only of its traditional arms and armor, but of the relation of its arms and armor with socioeconomic status, societal lifestyle, terrain, and tactics employed by the respective cultures.

In order to compare with other regions, the fourth topic will examine East Asian arms and armor. Three different cultures in particular will be examined: India, China and Japan. The arms and armor of each culture will be examined with overlays of the history and social context of the museum artifacts given the age of the piece. The research will also focus on the evolution of arms and armor through time and the influence of other cultures on the artifacts' development.

Topics and Subtopics

The Ancient World

- Ancient Greece – Corinthian Helmet
- Early Roman Republic – Montefortino Helmet
- Roman Republic – Gladiator Helmet

European Middle Ages and Renaissance

- European Middle Ages – Knightly Weapons
- European Renaissance – Rapiers and Short Swords
- European Renaissance – Firearms and ¾ Cuirassier
- European Renaissance – Pikeman Arms and Armor

Arms and Armor of Asia

- Sudanic Panoply
- Mughul Panoply
- Ottoman Turkish Panoply
- Samurai Arms and Armor

Target Sources

Core works

Primary sources

Visual sources

Audiovisual sources

Target Components

Famous Names & Events

Technology

Social status in relation to Military status

Plan of Work

A Term

Primary Deliverables

- *Individual research documents.*
- *Working video script with portfolio/list of visuals.*
- *Video trailer.*

Week 1

Group:

- *Read resources and begin note outline.*
- *Request source materials through inter-library loan.*
- ***Bring in** bullet-point group-brainstormed list of video contents/features*

Week 2

- Each watch a documentary and **bring in** a page of comments (can be bullet-list)

Cinematography:

- Talk to film/editing consultant
- Watch a video from a previous group
- Be prepared to discuss

The Ancient World

- **Submit** Corinthian Helmet
- **Submit** Samurai
- **Submit** Ottoman Turkish Panoply

Week 3

Cinematography:

- Talk with Devin Kurtz and Bill Short about previous videos made
- Be prepared to discuss

The Ancient World

- **Submit** Gladiator Helmet
  Submit Sudanic Panoply
- **Submit** Mughul Panoply

Week 4

Group:

- ***Update** talking head list*

Cinematography:

- Watch a previously made video
- Draft video outline

The Ancient World

- **Submit** Montefortino Helmet
- **Submit** Pikeman
- **Submit** ¾ Cuirassier

Week 5

Group:

- ***Update** and expand video outline*

Cinematography:

- Video

The Ancient World

- **Submit** Knightly Weapons
- **Submit** Firearms
- **Submit** Rapiers and Short Swords

Week 6

Group:

-
- ***Submit*** *draft video script*
- ***Submit*** *video sample (30-second trailer)*
- *Schedule filming*

Week 7

Group:

- ***Submit*** *full drafts of individual research documents*
- ***Update*** *Proposal*
- ***Update*** *video script*
- ***Submit*** *preliminary portfolios of stills for documentary, and list of desired images and footage*

B Term

Primary Deliverable

- *Full draft of video.*

Week 1

Group:

- ***Update*** *script*
- *Film/gather AV materials*
- *Record working script*
- ***Bring in*** *list of narrators*

Week 2

Group:

- ***Update*** *script*
- ***Submit*** *edited film*
- *Film/gather AV materials*
- ***Bring in*** *list of selected music with permissions information*

Week 3

Group:

- ***Finalize*** *script*
- ***Submit*** *edited film*
- *Film/gather AV materials*
- *Photo Higgins artifacts*

Week 4

Group:

- *Record Narrators*
- *Design intro image and credits/other graphics*
- ***Submit*** *edited film*

Week 5

Group:

- ***Submit*** *edited film*
- ***Submit*** *credits list*

Week 6

Group:

- ***Submit*** *edited film*
- ***Submit*** *Task list for C Term*

Week 7

Group:

- ***Submit*** *full draft of video for review by museum staff*
- ***Submit*** *Revised plan of work*
- ***Submit*** *assembled research document for entire team*
- ***Submit*** *personal statements and portfolios*

C Term

Week 1

Group:

- *Brainstorm introduction*
- ***Bring in** digital files of all materials generated by the project*

Week 2

Group:

- ***Submit** introduction*
- *Brainstorm conclusion*
- ***Submit** appendices*

Week 3

Group:

- ***Submit** Conclusion*
- ***Submit** Abstract and Acknowledgements*
- *Generate Team bios/photos*

Week 4

Group:

- ***Submit** full project report*

Week 5

Group:

- ***Submit** Complete Electronic Version of Project*

Week 6

Group:

- ***Submit** all project materials on disks*

Week 7

Group:

- ***Submit** final disks, hardcopy reports, CDRs, personal statements and portfolios*

Resources

Ancient Greece References

Bradford, Alfred S., and Pamela M. Bradford. *With Arrow, Sword, and Spear: a History of Warfare in the Ancient World*. Westport, Conn.: Praeger, 2001. Print.

Connolly, Peter. *Greece and Rome at War*. Englewood Cliffs, NJ: Prentice-Hall, 1981. Print.

Grguric, Nicolas, and Angus McBride. "Introduction." *The Mycenaeans: C. 1650 - 1100 BC*. Oxford [u.a.: Osprey, 2006. 4-5. Print.

O'Connell, Robert L. *Of Arms and Men : a History of War, Weapons, and Aggression*. New York:

Oxford UP, 1989. Print.

Spaulding, Oliver Lyman, Hoffman Nickerson, and John Womack Wright. *Warfare; a Study of Military Methods from the Earliest Times,*. New York: Arno, 1972. Print.

Early Roman Republic References

Bradford, Alfred S., and Pamela M. Bradford. *With Arrow, Sword, and Spear: a History of Warfare in the Ancient World*. Westport, Conn.: Praeger, 2001. Print.

Connolly, Peter. *Greece and Rome at War*. Englewood Cliffs, NJ: Prentice-Hall, 1981. Print.

Gabriel, Richard A. *The Culture of War: Invention and Early Development*. New York: Greenwood, 1990. Print.

O'Connell, Robert L. *Of Arms and Men : a History of War, Weapons, and Aggression*. New York: Oxford UP, 1989. Print.

Spaulding, Oliver Lyman, Hoffman Nickerson, and John Womack Wright. *Warfare; a Study of Military Methods from the Earliest Times,*. New York: Arno, 1972. Print.

Roman Republic

Eckart Köhne, C. E. (2000). *Gladiators and caesars: the power of spectacle in ancient Rome.* Los Angeles: University of California Press.

Kyle, D. G. (1994). *Spectacles of Death in Ancient Rome.* Florence, KY: Routlege.

European Middle Ages to Renaissance - Knightly Weapons

Blair, Claude. *European Armour* circa *1066 to* circa *1700*. B.T. Batsford, Ltd., London, 1958; 2nd ed. New York: Crane, Russak and Co. Print

Contamine, Philippe. *War in the Middle Ages*. Oxford [Oxfordshire: B. Blackwell, 1986. Print.

*Edge, David, and John Miles Paddock. *Arms & Armor of the Medieval Knight*. New York: Crescent, 1988. Print.

Hopkins, Andrea. *Knights*. New York: Artabras, 1990. Print.

Nicholson, Helen J. *Medieval Warfare: Theory and Practice of War in Europe, 300-1500*. Houndmills, Basingstoke, Hampshire: Palgrave Macmillan, 2004. Print.

Tappan, Eva M. "Chapter 1." *When Knights Were Bold*. Boston; New York: Houghton Mifflin, 1911. 1-17. Print.

White, Lynn Townsend. *Medieval Technology and Social Change*. London: Oxford UP, 1964. Print.

Williams, Alan. *The Knight and the Blast Furnace: A History of the Metallurgy of Armour in the Middle Ages & the Early Modern Period*. Leiden: Brill, 2003. Print.

European Middle Ages to Renaissance - Pikemen

Bull, S. (1991). *An Historical Guide To Arms & Armor.* NY: Facts on File.

Douglas Miller, G. E. (n.d.). *The Swiss at War 1300-1500.* 1979: Osprey Publishing.

Fryer, D. J. (1969). *Antique Weapons A-Z.* London: G Bell & Sons LTD.

Karcheski, W. J. (1995). *Arms and Armor in the Art Institute of Chicago* . Chicago: The Art Institute of

Chicago.

Paddock, D. E. (1988). *Arms & Armor of the Medieval Knight* . NY: Bison Books Corp.

Waldman, J. (2005). *Hafted Weapons in Medieval and Renaissance Europe : The Evolution of European Staff*

Weapons Between 1200 and 1650. Brill, N.H.E.J., N.V. Koninklijke, Boekhandel en Drukkerij .

Webb, H. K. (1965). *Elizabethan Military History.* London : University of Wisconsin.

European Middle Ages and Renaissance – ¾ Cuirassier

Blair, Claude, and Leonid Tarassuk, eds. *The Complete Encyclopedia of Arms and Weapons*. New York:
Simon and Schuster, 1979.

Hale, J.R. *Renaissance War Studies*. London: Hambledon Press, 1983. Print

"Men in Armor Singled Out." 2010. *The History Channel Website*. May 8 2010, 10:08 http://www.history.com/videos/men-in-armor-singled-out.

European Middle Ages and Renaissance - Firearms

Brooks, Richard. *Atlas of World Military History*. London: HarperCollins*Publishers*, 2000. Print.

Blair, Claude, and Leonid Tarassuk, eds. *The Complete Encyclopedia of Arms and Weapons*. New York:
Simon and Schuster, 1979.

Hale, J.R. *Renaissance war studies*. London: Hambledon Press, 1983. Print

Western Asia - Ottoman Turkish Panoply

Craig, Albert, and Graham, William. *The Heritage of World Civilizations*. Upper Saddle River, New Jersey: Prentice Hall, 2005.

Hilliam, Paul. *Islamic Weapons, Warfare, and Armies: Muslim Military Operations Against the Crusaders.* New York: Rosen Pub. Group, 2004. Print.

Nicolle, David. *Armies of the Ottoman Turks 1300-1774.* London: Osprey, 1983. Print.

Tarassuk, Leonid and Tarassuk, Claude Blair eds. *The Complete Encyclopedia of Arms & Weapons: the Most Comprehensive Reference Work Ever Pub. on Arms and Armor.* New York: Simon & Schuster, 1982.

Africa – Sudanic Panoply

Craig, Albert, and Graham, William. *The Heritage of World Civilizations*. Upper Saddle River, New Jersey: Prentice Hall, 2005.

Fischer, Werner, and Zirngibl, Manfred. *Afrikanische Waffen*. Passau, Germany: Prinz-Verlag GmbH, 1978.

Nickel, Helmut. *Arms and Armor in Africa*. Atheneum, 1971. Print.

Spring, Christopher. *African Arms and Armor.* Washington, D.C.: Smithsonian Institution Press, 1993. Print.

Eastern Asia – Japanese Samurai

Bull, S., & North, T. (1991). *An Historical Guide to Arms & Armor.* New York: Facts on File.

Deal, W. E. (2007). *Handbook to life in medieval and early modern Japan.* Oxford University Press US.

Metropolitan Museum of Art (New York, N. B. (1915). *Handbook of arms and armor: European and Oriental, including the William H. Riggs collection.* The Gilliss press.

Oscar Ratti, A. W. (1991). *Secrets of the samurai: a survey of the martial arts of feudal Japan.* Tuttle Publishing.

Thomas Louis, T. I. (2008). *Samurai: The Code of the Warrior.* Sterling Publishing Company.

Turnbull, S. (2006). *Samurai - The World of the Warrior.* Osprey Publishing.

Eastern Asia – Mughul India

Elgood, R. (2004). *Hindu arms and ritual: arms and armour from India 1400-1865.* Eburon.

Lord Egerton of Tatton, I. M. (2002). *Indian and Oriental Arms and Armour.* Courier Dover Publications.

*Pant, G. N. (1983). *Indian arms and armour* . New Delhi : Army Educational Stores.

Paul, E. J. (2005). *Arms and Armour: Traditional Weapons of India* . Roli Books Private Limited.

*Rawson, Philip S. *The Indian Sword*. New York: Arco Pub., 1969. Print

Robinson, H. R. (1967). *Oriental Armour* . New York : Walker and Co.

Tetreault, B. R., Mai, V. Q., Holmes, M. J., & Conklin, J. J. (2003). *Arms and armor of South Asia.* IQP Jeffrey

L. Forgeng.

Contact Information

General Contacts

Professor J. Forgeng	Phone – (508) 831 5442 jforgeng@wpi.edu
Devin Kurtz, Higgins Armory Education Director	Phone – (508) 853 6015 ext 15 dkurtz@higgins.org

IQP Group Contact Information

Fernando Martell	Phone – (508) 667 7248 Fmartell@wpi.edu
Nick Roumas	Phone - (508) 361 7250 nroumas@wpi.edu
Jacquelin A. Blair	Phone – (508) 579 2325 JABlair@wpi.edu

Video Contacts

Contact	Email	Notes
Andy Volpe	palasbuteo@hotmail.com	Ancient Time consultant
Bill Short	short@hurstwic.org	Cameraman; video consultant
Bob & Jen Reed	jlr@mitre.org	Firearms Reenactment Consultant
Jim Monaco	jmonaco@wpi.edu	Video Consultant
Richard Wagner	sirrichard@hughes.net	Non-European Consultant
Paul Kenworthy	mesketet@tiac.net	Pikeman Reenactment Consultant
Luke Knowlton	lukeknowlton@yahoo.com	Wheelock Reenactment
Hunter Heilen	dracus@speakeasy.net	Matchlock Reenactment
Steve Colonies	sjcolonies@verizon.net	Flintlock Reenactment

Potential Talking Heads

Contact	Email	Notes
Prof. Forgeng, WPI/HAM	jforgeng@wpi.edu	
Richard Wagner	sirrichard@hughes.net	Non-European Consultant
Prof. E. Malcolm Parkinson	emp@wpi.edu	Historian
Stuart Mowbury	stuart@manatarmsbooks.com	Historical Arms Scholar
Dr. John Waltman	halberdjw@comcast.net	Medieval & Renaissance Arms Consultant
Prof. Thomas Martin	tmartin@holycross.edu	Ancient World Consultant
Richard Colton	Richard_Colton@nps.gov	

Video Parameters and Assets

Script	Target c. 1600 words for a 15-minute video
Music	Creative Commons
Narrator(s)	One main; additional for primary source quotes
Still images	~77 in total film
Primary source quotes	Target at least 8 in each individual's research document.
Live footage	Data base of existing footage, plus new footage from current team

Artifacts List

Artifacts – Ancient Greece to European Middle Ages

Ancient Greece - Armor

Artifact	Origins	Time Period	Accession Number
"Corinthian Helmet	Greece	About 550 B.C.E.	239; 1143;2038

Roman Republic - Armor

Artifacts	Origins	Time Period	Accession Number
Gladiator Helmet	Roman	About 1st century C.E.	1129
Montefortino Helmet	Italy	About 400 – 100 B.C.	1135

Artifacts – European Early Modern Period to World War I

European Early Modern Period - Armor

Artifacts	Origins	Time Period	Accession Number
¾ Armor for Cuirassier	Augsburg	1620 – 25	1000

European Early Modern Period – Arms

Artifacts	Origins	Time Period	Accession Number
Pair of wheel-lock holster pistols	Nuremberg	1650	1997.04. a – b
Wheel-lock holster pistol	Suhl	About 1625 – 50	2004.04.1
Wheel-lock carbine for a harquebusier	Germany; Netherlands	1640 – 50	2001.01
Puffer (Wheel-lock holster pistol)	Saxony	1588	1997.02
Matchlock musket	Germany	End of 1500s – early 1600s	460

European Early Modern Period – Works of Art and Literature

Artifacts	Origins	Time Period	Accession Number
"Venus at the Forge of Vulcan, or an allegory of Fire"	Flanders	1606 – 23	6166
"The Conquest"	Britain	1884	6163
Colored engraving of two fencers from	Britain	1763	2000.01

Angelos "L'Ecole des Arms"			
Charcoal study for "The Nightwatchmen"	America	1962	6235.1
"The Art of Warre or Militarie Discourses"	England	Printed in 1630	2007.110
"Militarie Discipline: or the Young Artilleryman"	England	Published in 1643	2007.111
"Die Kunst des Fechtens" ("The Art of Combat")	Augsburg	1600	2004.02
Bronze Statuette "Jeanne d'Arc"	Paris	About 1874	1983.01.1

Artifacts – Western Asian and African Armor

Arab Islamic, Persian and Turkish - Armor

Artifacts	Origins	Time Period	Accession Number
Mail coat	Persian or Ottoman	1550-17th C.	2698
Shaffron (horse's head armor)	Ottoman	1560	1560
Buckler (shield)	Sudanese	19th C.	2414
Helmet	Sudanese or Nigerian	late 19th C.	3050
Mail Coat	Sudanese	19th C.	397

Arab Islamic, Persian and Turkish – Arms

Artifacts	Origins	Time Period	Accession Number
Yataghan	Ottoman	1775-1800	3567.a
Scabbard for yataghan	Ottoman	1775-1800	3567.b
Kilij (sword)	Ottoman	18th C.	3267.a
Kaskara	Sudanic region	19th C.	2058
Scabbard	Sudanese	19th C.	2416.b
Composite bow	probably Ottoman. Maybe Persian	18th C.	2409
Spear	Sudanese	19th C.	78

Artifacts – Eastern Asian Armor

China & Japan – Arms

Artifacts	Origins	Time Period	Accession Number
Matchlock musket	Japan	1750-1800s	2083
Matchlock musket	Japan	About 1835 - 40	1863.1

India – Armor

Artifacts	Origins	Time Period	Accession Number
Mailshirt	India	1700s	1173
Mail Hood	India	1700s	1538

India – Arms

Artifacts	Origins	Time Period	Accession Number
“Jamadhar (punch dagger)”	India	1700s	1108.a
Pata (sword)	India	1800s	2061
Jamadhar (punch dagger)	Northern India	About 1700s	1552
Jamadhar	Europe; India	1700s	1553